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THE INVENTORS' INSTITUTE,
4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE.

Chairman of the Council—**SIR ANTONIO BRADY.**

THE various efforts which have been made, and the numerous influences now at work to injure, if not to destroy, Patent Rights; the inefficiency of the many well intended, but ill considered, schemes of Patent Law Reform which have from time to time been suggested, and the tendency of which has generally been to prejudice the Inventor, without advantage to the Public; together with the proceedings so essentially involving the interests of inventors which have already taken place in Parliament, show the necessity of an immediate and active co-operation on the part of those interested in Inventions and in Patent Property, and that an Association for the Protection and Defence of Patent Rights is urgently needed. This Institute has, therefore, been established for the purpose of uniting and organizing the influence of Inventors, Patentees and others. Its objects are:—

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3rd. To facilitate the diffusion of information with reference to Inventions and other subjects beneficial to Inventors and Patentees.

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APPLICATIONS FOR LETTERS PATENT.

⁎ In this list (Com.) means Invention communicated from abroad.

Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur-street, Charing Cross.

On March 7th.—822 to 831.—W. M. Brown. Machine for lasting boots and shoes (com. by J. W. Brooks). (Complete specification.)—W. Wright. Manufacture of gas for heating and illuminating purposes, and apparatus for the same, parts of which are applicable to other purposes.—W. R. Watson. Fixing the tubes of steam boilers, condensers, vacuum pans, and other vessels.—W. H. Bennett. Process of packing and preserving hams, bacon, and other cured meats (com. by J. K. Collet).—E. Worroll. Apparatus for withdrawing water from pipes heated by steam, and arrangements in connection therewith.—H. B. Barlow. Apparatus employed in the concentration of sulphuric acid (com. by N. J. Galland.—J. Hargreaves and T. Robinson. Manufacture of sulphate of soda and of potassa, and the production of chlorine.—E. L. H. Jobert, Count d'Epineuil. Construction of apparatus and means for producing economy in the consumption of fuel.—E. R. Allfrey. Slide valves applicable to steam and other engines.—T. E. Bonnar. Washing machines.

On March 8th.—832 to 847.—G. H. Tatham. Construction of railways, rolling stock for same, and other apparatus connected therewith.—J. Gratrix. Improved apparatus for saving coals and diffusing heat.—J. Keene. Amalgam for the better imitation of silver (com. by Madame P. Baudoin).—G. H. Forbes. Combustible compound designed to be used as fuel or for making lime, to be designated "chalk coal."—J. Jobson, E. W. Jobson, and G. Jobson. Open fire-places for heating apartments or chambers. —R. W. Edwards. Imparting brilliancy to relief stamping or printing.—W. J. Mayes. Furnace bars.—G. Little and T. C. Eastwood. Combing machinery.—G. Lund. Improved cloth for umbrella covering.—J. Wadsworth. Utilizing refuse matter for the manufacture of fuel and manure.—T. Hampton. Manufacture of armour and other plates. (Complete specification.)—C. W. Harrison. Apparatus for charging or impregnating atmospheric air with the vapour of hydro-carbon liquids.—J. Burley. Infants' feeding bottles.—R. Jukes. Consuming smoke economizing fuel, and producing light, and the apparatus employed therefor. H. Skoines. Manufacture of gas and the treatment of the residues therefrom, and the combination of gases for the production of light and heat, and the apparatus employed therein.—F. Kuhlmann. Utilizations of the acid residues resulting from the manufacture of chlorine.

On March 10th.—848 to 862.—J. Reidy. Improved pick or pickaxe for excavating, mining, and other purposes.—H. Dean. Improved trap for preventing the ingress of sewer gas into houses and other buildings.—T. Loveridge. Carding buttons in series or sizes for sale, more particularly applicable for carding the description known as linen buttons.—T. Smithdale. New auxiliary screw propelling apparatus to be applied to fishing craft or other sailing vessels.—A. Fayol. Frame for parasols, umbrellas, sunshades, and other such like articles.—J. Rowley. Working of coal gas tar.—E. Galeer. Hair wash.—E. T. Hughes. Fur-coated fabrics (com. by H. Kellogg).—J. Gilmore and D. Hodgson. Gill boxes.—R. K. Jones. Apparatus to be used in discharging cargo from ships.—J. H. Mapleson. Construction of tent and arrangements of frames or fittings for the same and for other tents.—H. C. Lawton. Fire-places and flues for consuming and economizing fuel for heating and ventilating rooms and buildings.—C. T. Remmett. Coal boxes or scuttles.—W. C. Barney. Electric telegraphs. (Complete specifications.)—G. Horner and A. Dobson. Steam boilers.

On March 11th.—863 to 882.—H. Page. Manufacture of paper pulp or half stuff.—W. Woodcock. Stoves and fire-places.—G. P. Dodge. Hose pipes (com. by G. McKay).—G. Gibson, W. J. Taylor, J. P. Bardsley, and R. J. Fletcher. Manufacture of felt hats or other coverings for the head.—G. Mathis. Sculpture copying apparatus.—W. Weldon. Manufacture of chlorine by means of compounds of manganese regenerated in the wet way.—J. S. Raworth. Weaving handkerchiefs.—I. Hayward. Machinery for rolling wire, rods, hoops, or other sections of metal.—C. Hore. Horse clippers. —W. Heaton and H. Giddings. Ball cocks or valves used for controlling or regulating the supply of water and other fluids.—J. C. Ramsden. Method or apparatus for securing the combustion of fuel.—B. Hunt. Machinery or apparatus for trimming or burnishing the edges of the soles and heels of boots and shoes (com. by S. H. Hodges).—T. B. Wilson. Apparatus employed in the manufacture of salt.—H. P. Holt. Steam engines and surface condensers. —W. R. Lake. Finishing the soles and heels of boots and shoes (com. by L. R. Mears).—W. Mather. Construction of steam drying cylinders.—J. M. Rigby. Drill heads for rock boring and tunnelling.—F. H. Dunnett. Construction of presses for stamping and embossing. —A. M. Clark. Graining and marbling surfaces, and the means employed therefor (com. by J. J. Callow.—H. Harrison. Apparatus for preparing peat for fuel, applicable also for crushing and working or kneading clay and other like substances.

On March 12th.—883 to 906.—W. Sadler. Propelling carriages on tramways.—W. S. Fish. Manufacture of asbestos packing for piston and valve rods, pistons, pipe joints, and other similar purposes.—W. Thomson. Blocks for hoisting and lowering weights, which may also be used for steering ships.—R. Wilson. Con

BRITISH MUSEUM

structing and arranging the winding apparatus used for raising and lowering weights in collieries and mines, and for other analogous purposes.—L. Sauret. Improved mode of advertising.—B. Rudulph. Sewing machine for uniting the selvedges of stockings and other hosiery.—J. M. Stanley. Construction of furnaces for the more completely utilising the heat generated therein.—J. E. Acklom. Railway and other carriages for the conveyance of animal and vegetable substances used for food, which improvements are also applicable to other chambers for the storing of such substances.—J. Jones. Combinations of substances or materials to be used as a substitute for coal, for obtaining heat and light, and the arrangement of the furnaces or fire-places connected therewith.—S. Lang. Construction of fire-grates for domestic use so as to economize the fuel used in the same.—G. Spencer. Pulley blocks.—R. J. Jones. Operations and apparatus for drying down waste alkaline solutions of extractive matter obtained in preparing vegetable fibrous material for use in the manufacture of paper, and in recovering therefrom the alkali for re-use, also for utilizing the vapours given off during the boiling of the vegetable material or the drying down of the said solutions.—T. Radcliffe. Improved mode of treating rooms, railway carriages, and similar places, and the apparatus used therefor.—S. B. Darwin. Means of manufacturing gas.—J. Oglesby and J. A. Jackson. Domestic fuel economizer.—J. Oldroyd, M. Oldroyd, the younger, J. Woodcock, and J. Coulter. Machinery or apparatus employed in dyeing, bleaching, scouring, and waterproofing woollen or other woven or felted fabrics.—W. J. Coogan. Machinery for boarding, softening, and graining leather.—D. Adamson. Steam boilers.—G. Wood. Construction of furnace or kiln, and the means and apparatus for the application of gas for heating such furnace or kiln, and also for heating purposes generally.—F. B. Houghton. Means of, and apparatus for, filtering or separating water from earthy bodies, from which cements and similar bodies are made.—S. Warne. Manufacture of woollen fabrics (partly com. by R. Pinti).—L. Strange. Baling cotton and other materials (partly com. by J. A. Cameron and J. Frier).—D. W. Fish. Hand stamps.—G. Smith. Machinery or apparatus for obtaining motive-power, parts of which improvements are applicable to the raising, forcing, and measuring of fluids, and to the reduction of friction in bearings.

On March 13th.—907 to 925.—A. Tylor. Apparatus and arrangements for measuring water, and regulating, controlling, and arresting the water supply of water-closets, baths, lavatories, and urinals, for domestic and other use, and preventing waste.—J. T. Griffin. Carpet or power looms, parts of which are applicable to other looms in which carpets or similar fabrics are woven (com. by H. M. Babbett, C. W. Miles, and P. Hickey).—J. C. Edington. Mode of preventing vessels from sinking, and of raising sunken vessels.—F. H. Stubbs and G. H. Cottam. Coal-cutting machines.—S. Alley. Springs.—R. S. Symington. Apparatus for dealing with sewage, and other refuse or waste, so as to lessen the pollution of rivers.—M. Baerlein. Apparatus for drying yarn to be used in connection with sizing and other machines.—H. A. Bonneville. Regulator or governor for adjusting the speed or rotary motion of steam engines (com. by E. Schenck, Baronet, and W. Maurer.)—W. McEwen, M.D., J.P. Instrument to render tender and disintegrate the tissue of meat before cooking.—C. Moseley. Apparatus for condensing the vapours of naphtha.—J. Baladia and T. Osborne. Manufacture of knitted fabrics.—N. J. Suckling. Chaff-cutting machines.—A. Wallis and C. J. Steevens. Means and apparatus for protecting feed water-heaters against the effects of frost.—T. Black. Equilibrium berths or cabins for navigable vessels.—W. Mickle. Fuel, and economising fuel used in the boiler furnaces of the engines of screw and other steam ships, and of locomotive or railway or other engines for raising steam, and other steam boiler furnaces. (Complete specification.)—H. T. Christie. Apparatus for saving life at sea.—J. Head. Steam engines and generators.—W. S. Fish. Non-conducting covering applicable for steam boilers and engines, which may also be used for preventing the radiation of heat generally.—D. C. Miller. Distilling, evaporating, concentrating, agitating, and otherwise treating liquids, part or parts of which are also applicable for granulating or crystallising materials in solution or mixed liquids.

On March 14th.—926 to 946.—E. A. L. Roberts. Treating explosive compounds to impart safety thereto for blasting and other purposes.—A. Greenwood. Drawing and spinning frames.—C. M. White. Stoppers for bottles and other articles.—J. Drew. Improved compendium or receptacle applicable to various useful purposes.—J. R. Francis. Process and machinery for separating magnetic from non-magnetic substances, and especially magnetic oxyd of iron from all foreign material (com. by F. A. H. la Rue).—E. Bevan and T. Drew. Treatment of vegetable substances to obtain paper pulp and fibres.—G. Haseltine. Mode of, and apparatus for, casting steel (com. by W. Dougherty). (Complete specification.)—W. R. Lake. Rotary pumps for lifting and forcing water (com. by S. West and L. Goodwin).—W. Hounsell. Manufacture of copper tubes.—S. Corbett. Ploughs, and attaching rotating forks or pulverizers to ploughs.—J. Pumphrey. Sifters or screens for sifting or screening cinders and for other like purposes.—G. F. Deacon. Apparatus for measuring the flow of water in pipes.—E. T. Hughes. Manufacture of the salts, carbonates, and hydrates of baryta and strontia, and also for improved modes of making baryta and strontia caustic (com. by L. G. G. Daudenart and E. Verbert.—E. T. Hughes. Treatment of greasy and washing liquors used in scouring or cleaning wool by caustic baryta or strontia (com. by L. G. G. Daudenart and E. Verbert.—C. H. Maleham and T. Mirfin. Breech-loading snap action fire-arms.—J. Holmes and J. Holmes. Shuttles for weaving.—T. Harris. Appliances for attaching lines to sliding sashes of windows, and the pulleys employed therewith.—M. Eustace. Cultivation of green crops by the use of a machine for the spacing of same, termed "green crop spacing" machine.—W. R. Lake. Manufacture of mosaic veneers or tiles, and apparatus therefor (com. by H. F. Kruse.—A. M. Clark. Treatment of peat for fuel, and apparatus for the same (com. by J. F. F. Challeton).—R. M. Melhuish. Machine for sewing button-holes, and for fancy stitching.

On March 15th.—947 to 971.—Construction of straw elevators, and an improved method or means of driving or actuating the same.—R. Mills. Gas furnaces.—C. Midgley. Fire-grates adapted more particularly for domestic purposes.—W. Crighton, W. W. Crighton, and S. Crighton. Methods of, and apparatus for, controlling the formation of the lap in lap-machines and other analogous machines.—B. Smith, J. Stake, R. Tolson, M. Firth, and C. Bradley. Apparatus for the combing of wool and other fibres.—B. Noble and J. Armitage. Means and apparatus for cleaning yarn.—E. Hollis. Mode of attaching and detaching certain parts of the stocks of breech-loading and other sporting guns.—R. Paterson. Collapsable casks or vessels for containing fermentable or aerated beverages.—J. T. Wibberley. Machinery or apparatus for winding cotton, silk, wool, or other threads on spools or reels.—W. A. Lyttle. Permanent way of railways.—J. Robey and G. F. Chantrell. New or improved filtering and deodorising medium.—L. Simon. Rotary printing machine (com. by Bullock Printing Machine Company.—W. A. Gilbee. Stopper for bottles and other vessels (com. by J. L. Megret).—T. A. Weston. Apparatus for transmitting, regulating, and arresting motion in machinery.—W. Ramsden and J. Ramsden. Machinery for twisting and doubling yarn or threads.—J. Dunn, Jun. Apparatus to be used in connection with stoves for the purpose of economising fuel.—H. Gardner. Apparatus and means for utilising spirituous substances and oils for the purposes of producing artificial light and heat.—J. Wright. Means or apparatus employed in the consumption of smoke and for economising fuel.—J. Mowbray. Means or apparatus for preventing loss of life or other accidents in coal or other shafts.—H. J. Haight. Artists' scrapers. (Complete specification.)—G. Haseltine. Pump pistons and valves (com. by I. K. Harwood). (Complete specification.)—J. Adams and B. Jenkins. Engines operated by heated air and steam combined.—W. H. Shepherd and J. Scott. Machinery for combing wool and other fibres.—C. Robey, E. Banks, and T. Forrester. Construction of kilns or ovens for firing bricks, earthenware, china, pottery, and such like substances (partly com. by De Bettiqnies Bros.)—S. Hall. Machinery for moulding and compressing blocks of fuel, peat, clay, and other like substances.

On March 17th.—972 to 989.—J. Burton. Invention of an improvement in or connected with pianofortes.—J. G. Tongue. Stopping motions or apparatus applicable to knitting, and other machinery (com. by G. F. Lufbery.—W. R. Watson and R. A. Robertson. Filtering liquids, and the machinery or apparatus employed therefor, being more especially adapted for filtering saccharine solutions.—W. E. Debenham. Apparatus to be employed for raising or lowering submerged vessels or other bodies.—J. Barling. Fire-grates and stoves.—W. S. Crondace. Dumb compasses, and apparatus connected therewith, such apparatus being applicable to other purposes.—S. Haley. Construction of stoves and fire-grates for economising fuel.—J. Ruston. Steam boiler furnaces, mainly applicable for agricultural and portable engines. G. T. Bousfield. Manufacture of cheese (com. by H. O. Freeman). (Complete specification).—G Rowe. Weaving ornamental fabrics.—R. C Sayer. Apparatus for coupling and uncoupling railway trucks and carriages.—Rev. H. R. Hawers. Ecclesiastical decorations for screens and other parts of cathedrals and churches, applicable also to public and private buildings.—J. Strickland. Manufacture of railway and other wheels, and machinery and furnaces used in the said manufacture.—H. Gardner. Means and appliances for the heating of boilers and other similar vessels.—H. W. Cook. Locomotive engines and the mode of and apparatus for condensing steam in such or other engines.—L. F. Raimond. Improved box or case containing several commercial articles.—J. Thurlow. Self-acting mules for spinning.—E. Thornton. Cooking apparatus or kitchen ranges.

On March 18th.—990 to 1001.—A. Barclay. Manufacture of pig iron and furnaces or apparatus employed therefor.—G. B. Cooper. Stoves and fire-places.—J. E. Standfield. Carriages.—J. D. Merriman. Apparatus for lighting and extinguishing public and other lights.—W. Hull. Suspending, driving, and balancing horizontal millstones.—H. F. Gough. Printing and the means therefor.—E. Dean. Making ships' boats and rafts buoyant.—J. Burton and H. Smith. Manufacture of net or lace in twist lace machines.—E. Hare and J. O. Ardron. Rotary screens for dressing and separating grain and seeds.—A. M. Clark. Peat machines (com. by C. Luxton).—C. H. O. H. d'Arros. Electro running wheel engine.—J. H. Johnson. Laying pipes across rivers, creeks, lakes, and other pieces of water (com. by J. F. Ward).

On March 19th.—1002 to 1028.—J. Perrier. Glass gas chimney, capable of resisting any degree of heat without bursting.—W. H. Goodchild and S. F. Hay. Joiners' clamps.—T. B. Coddington. Manufacture of materials, such as blocks, slabs, pillars, tubes, and such like, suitable for building and for other purposes (com. by G. De Whitt and J. Fairman).—T. Moy and R. E. Shill. Fitting water tubes, applicable to steam boilers and engines.—J. T. Woods and C. Baron de Malortie. Furnaces for economizing heat and burning inferior fuel.—G. Newton. Improved lubricant.—J. Farmer and J. B. Hamilton. Construction of musical instruments.—G. C. T. Bartley. Fire-places.—R. J. Fremlin. Purifying fusty and otherwise impure casks, and in seasoning new casks and timber to be made into casks.—E. Turner. Manufacture of packing for glands.—A. Jaynor. Construction of automatic telegraphs, to be worked by air, steam, or gas.—J. Grimes. Machinery or apparatus employed in the preparation or manufacture of the heels of boots or shoes.—J. B. Fell and G. N. Fell. Construction of light railways.—W. H. Hacking and T. Hacking. Machinery for plaiting or folding and measuring woven fabrics.—N. Whitley, H. Hoyle, and J. Haigh. Card setting machines.—E. T. Hughes. Curtain fixtures (com. by C. Buckley and L. L. Sawyer).—R. Toone, H. Z. Archer, and E. Hartshorn. Manufacture of lace in twist lace machines.—J. B. Winslow. Wire pegs for boots and shoes, and in machines for using the same. (Complete specification).—Rev. T. Wolstencroft. Warming dwelling-houses and other buildings, economizing fuel, burning slack, reducing the bulk of the refuse, improving draughts, and curing smoky chim-

(CONTINUED ON PAGE 14.)

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JOURNAL OF THE INVENTORS' INSTITUTE.

MAY 1, 1873.

THE COMING PATENT LAW BILL.

Again the alarm is sounded! Again inventors are bidden to prepare for battle! The present Lord Chancellor, Lord Selborne (who, under his former name of Sir Roundell Palmer, was well known as a determined opponent of any system of Patent Law, or legal protection for invention), has undertaken to bring a Bill before the House of Lords, dealing with this branch of the law. What is the exact nature of the Lord Chancellor's legislative proposals we are not in a position to state. They may be very judicious and appropriate, such as everybody would be justified in expecting as emanating from so high an authority and from a man so esteemed for his learning and rectitude; or, they may be—as we fear they will be found to be—the definite and determinate expressions of that hostility to the claims of inventors, wherein his lordship has already proved himself to be a doughty champion. And in this aspect every watchful advocate of the inventor's cause must view the matter,—in order that they may obtain a successful peace, they must at once prepare for war.

Viewing affairs in this way, we are much pleased to find that the Inventors' Institute is taking steps to combat the enemy, its Council being in communication with several Members of Parliament, with the view to concert measures for dealing with the Lord Chancellor's propositions when they come before the Legislature.

We trust that in this matter there will be no half-heartedness—no attempt to give a sop to Cerberus, for we feel sure that any such attempt will prove a failure, as it will only result in rendering Cerberus more lively and vicious. The whole question is one of justice and public policy—justice, because whoever exerts himself in matters of honest industry is entitled to remuneration for his work; public policy, because it is a wise and reasonable thing to use every means calculated to promote the growth and practical development of new inventions; and as in the walks of ordinary, and, so to speak, imitative industry, so in this extraordinary path of originative industry—invention—there is in the present constitution of society no other reliable method of promoting progress than that of assuring to every man his fair chance of remuneration for his industrial exertions.

The best course for those who champion the inventor's cause is for them to insist upon the justice of his claims to the security of a special property in his inventions, which can only be satisfactorily effected by showing that it is not the mere utterance of bare suggestions of the possibility of effecting certain industrial improvements that constitute what is termed invention, but utterance combined with practical demonstration; for it may possibly be true that there is not much due to those who content themselves with putting forth mere suggestions, beyond what may be termed the prize of "Honourable Mention;" whilst those who combine practical demonstration with valuable suggestion engage in important labour, from which the commonwealth cannot fail to receive much benefit; and the fact must never be allowed to be lost sight of that to demonstrate the practicability of a new invention necessitates the application of time, talent, and money to that object; and this is worthy of its own special reward according to all our notions of equity (outside of Chancery law fancifully termed equity by our lawyers)—notions that are, if not innate yet have the sanction of men of all times and many countries, and are moreover recognised and confirmed by teachings of the highest of authorities, which bids us take note that no man "goeth a warfare at any time of his own cost," or "planteth a vineyard and eateth not of the fruit thereof." But therein the practical fallacy of proposing to remunerate the inventor by any system of Government awards must be repudiated, for such a system is shewn by experience to be impractical and illusory, only to be resorted to in some very special cases where no other course appears to be open to us.

Moreover, the absolute similarity of the author's copyright, which few call in question, and the inventor's patentright, must be stoutly maintained, for they are, in truth, "as like as two peas,"—for the author puts his (more or less) original thoughts into words and makes a book (and a book, when written or printed, is literally an article of *manufacture*)—the inventor embodies the results of his thoughts and labour in a new machine or process, which the law terms a manufacture; and the patenting of an invention no more hinders the production of a better invention for the same subject, than the copyright of a book hinders the production of a better book on a similar subject.

But it must not be forgotten that if the inventor's right to a patent or special property in an invention is sound on principles of justice, it is equally sound as a matter of public policy; for who will think of relying on labour which promises no one any special benefit? For, independently of its being true that "reward sweetens labour," it is also true that most men who labour have to subsist by that labour; hence not only the spur of cupidity, but the goad of necessity is involved in the matter—two powerful instruments, whose action may be implicitly relied on when public spirit, philanthropy, and many other grand attributes of humanity are flagging or inactive. And it must be remembered that many members of the working classes are inventors, and that to them the question of obtaining their daily bread by any occupation they undertake is a paramount one. As to the particular form which any reform in the Patent Law ought to take, we feel it unnecessary to do more than remind our readers that a very good plan of reform is sketched out in the Invention-right Bill drafted by the Inventors' Institute, and already published in the columns of the Scientific Review.

But whether that plan or some modification of it be adopted, yet these primary points must be adopted—Cheap Patents (and especially cheap Provisional protection, or an equivalent for it), effective non-litigious Patents, and Patents of sufficiently long duration to guarantee remuneration to the inventor.

Reviews.

Steam in the Engine: Its Heat and its Work.

By P. Kauffer, Managing Engineer, Leeds. London: Blackie and Son, Paternoster Buildings, E.C.; Glasgow and Edinburgh. 1873.

[Second Notice.]

Last month we briefly noticed the publication of this treatise, and commended it to the favourable attention of our readers. On a more careful consideration of its contents we have to remark that it is a book worthy of the attention of all engineers; indeed, of all interested in the use of steam, who have (as they should) scientific interest in the theory of its operation in the engine.

The work, which is one of only sixty-four pages, is profusely illustrated by diagrams and tables of practical results. When a subject is so fully, yet concisely, treated as in the present work, it is difficult to quote from it anything which stands out beyond other parts as particularly worthy of attention. As it would be manifestly unfair to present our readers with its whole contents, though we are quite sure *they* would profit by our doing so; we are content to afford them the following sample:—

The question (says Mr. Käuffer) whether an economy in fuel can be obtained by the use of a steam-jacket round the cylinder, is not yet decided.

It is to be remembered that free heat has to be rendered latent in every case where steam expands under performing work; and if the steam-jacket were essential for an engine, if it were of any good to the steam inside the cylinder, its duty would be to assist the steam in its own transformation. Mr. Rankine, after he was astonished that more work is shown by the diagram than the steam lost in total heat, said that this plus was the result of transformation of latent heat into mechanical work, which, he added, cannot be estimated theoretically. To give a proof to this assertion, he says that in a non-jacketed cylinder the steam, when expanding, takes the form of a mist and spray, because, as some latent heat went through the piston as work, the steam condenses partly. To my regret, I cannot accept this statement, because, as I proved by calculation at the end of articles V. and VIII., the contrary must take place; that is to say, instead of latent heat being set free during the expansion, it must be that free heat becomes latent again, because the steam takes a greater volume. Latent heat is wanted to increase the volume of the water, and if a part of this heat disappears in the steam, will the consequence not be a reduction in volume? and how is it possible to reconcile a reduction in volume with an expansion, with an increase in volume? The volume must increase, or the piston will not advance in the cylinder.

The more volume 1 lb. of steam occupies the greater must be its latent heat. One lb. steam of × 32° Fahr. wants as latent heat 1092 units, where 1 lb. steam of 8 atm. total pressure, or 339·53° Fahr., wants only 875·16 units of heat to keep it in equilibrium with the weight it has to support. The molecules are nearer to each other, and want to vibrate in a smaller circle.

Another question to be considered here is the time during which the expanding steam is in contact with the inside wall of the jacket. When using, expansively, steam of 6 atm. total pressure in the engine, the total heat wanted, per 1 lb. of steam used, is 1266 units, of which not more than about 300 units are obtained as work in the engine. Thus, we see that ¼th of the total heating-surface in the boiler was wanted to transmit the heat equivalent to the performed work from the hot flame into the *water*. Knowing the enormous difference in conductive-power between steam and water, we can easily see how much more surface would be wanted in the boiler if there were steam instead of water; and if we give on the other side of the heated plates, instead of the hot gases, only steam of not much higher temperature than the steam has inside, then we see to how great an extent we would have to enlarge the heating-surface in order to exchange the same work. Reducing now this surface to the extent of the inner wall of the jacketed cylinder, the conclusion becomes evident that in the short time of contact, say one second, the heat transmitted through the cylinder-wall must be trifling. The case of the steam-jacket is that of a superheater, with very little surface compared to the quantity of steam (especially in large cylinders), and with a very small difference in temperature between the two mediums which shall interchange their temperature.

Other arguments against the steam-jacket are, firstly, that the same amount of heat given through the wall to the expanding steam will be given to that same steam during the exhaust-stroke; and, secondly, that by the steam-jacket the cooling-surface exposed to the external air is enlarged, and that this cooling is rendered more effective.

Many hundreds of steam-jackets have been applied in practice, and no maker and no user can state their value. I know of only a few experiments made with jacketed engines, and they are not conclusive enough to show any effect of the jacket produced inside the cylinder.

The opinion of some engineers that the steam should have still a few pounds pressure above that into which it exhausts, in order to leave the cylinder easier, is certainly erroneous. As soon as the exhaust valve opens, the steam takes immediately the volume corresponding to the pressure into which it has to flow, whether it were or not still compressed at the end of stroke. Were it compressed, it will be warmer than it should be at the corresponding pressure, and this raises the back-pressure, especially at a high speed.

That the steam-pipes and steam-ports for admission, as well as for exhaust, must be made as large in area and as short as possible, is a fact sufficiently known. The diagrams taken from working steam-engines show, often clearly, that the steam, which was at its maximum of saturation when leaving the boiler (it is well understood that I do not allude to any priming), had been superheated by keeping its original temperature, although the pressure is lowered when being forced through narrow passages into the cylinder. Consequently, without having steam warmer than before, this originally saturated steam is now to be called superheated steam, and has, as such, less energy than when at its maximum of saturation, compared by volume and pressure.

A certain increase of the expansion curve is in every engine caused by the clearance, which, being a volume not shown on the diagram drawn, but which was filled with full-pressure steam, causes the curve to be one corresponding to a longer introduction than the diagram shows, longer by the volume of the total clearance expressed in parts of the stroke. This correction must be made in every diagram before examining the law followed by the steam.

Speaking of correcting diagrams, Mr. Käuffer says, I must add a few remarks on a correction which is generally, even in scientific treatises, entirely neglected. This correction is not wanted for measuring the work performed by the engine: but it is certainly worth remembering in many cases in practice,—that is, the relative position of the back-pressure curve to the curve of the effective working-pressure. A diagram drawn from the front-end of the cylinder does not show the work performed during the front-stroke, because the diagram is composed of the steam-curve during the front-stroke, and of the back-pressure curve of the bottom-stroke; and if the real indicated work of the front-stroke alone is to be considered, we have to take the back-pressure curve of the bottom-stroke, and to place it instead of the back-pressure curve shown on the diagram. In cases of an unequal back-pressure this correction changes the diagram entirely with regard to uniformity of work.

Celestial Objects for Common Telescopes.

By the Rev. T. W. Webb, M.A., F.R.A.S., Vicar of Hardwick, Herefordshire. Third Edition, Revised and Enlarged. London: Longmans, Green, and Co. 1873.

The present edition of this now well-known and highly appreciated treatise is a decided improvement upon the two which have preceded it, the additions being such as render the work more accordant with the present state of science. Mr. Birks, and others, have, it appears, assisted the author in enriching the lunar map attached to the treatise. From the sidereal part some few objects of inferior interest have been omitted, but in their place nearly seventy fresh ones have been introduced. In the Appendix many useful things are introduced, such as Declinations in the Right Ascension Index, and recent information as to the planet Venus.

As this work is one that was originally introduced to public notice not a few years ago—and has been allowed, for various reasons, to remain out of print for some length of time, probably it may be wholly new to many of our readers: hence a sample of its style will be acceptible, as it will be seen it is of a readily readable kind rarely to be met with in books which contain such a full quantum of the technicalities appertaining to a science as Mr. Webb's book does.

Comets.—On this ever-interesting subject Mr. Webb remarks that when Kepler stated his belief not merely that comets inhabited the æther as fishes the ocean, but that the ocean was not fuller of fishes than the æther of comets, his contemporaries probably amused themselves with his luxuriant fancy, but that modern discoveries have proved that a vast number of these bodies exist. Many of them are so faint, and so much alike, as to afford little interest to the generality of observers. In fact, as Mr. Webb states, the light of most comets is too faint for high powers, and demands a contrast with the dark sky which small fields do not admit: to get the whole extent of head or tail the lowest power should be chosen, and for the tail the naked eye will be more effective than any glass, except the appropriate instrument called a comet-finder. High powers may be used for the details of the nucleus, but the contraction of the field and the want of contrast must always be allowed for. Small comets are frequently nothing but luminous mists without trains, sometimes without central condensation;—as we ascend in the scale, nuclei, trains, envelopes, and various anomalous appearances succeed, depending no doubt upon diversities in the materials of the comets themselves, as well as on their degree of approach to the sun. Even Venus was thought to have influenced the aspect of the "Donati" as it passed near her. In common language, a comet consists of *head* and *tail*; but we have to make a telescopic analysis, and shall begin with

1. The Nucleus: the most luminous part, occupying in a general sense the centre of the head. It is sometimes absent in telescopic comets, which are mere fogs, permitting the minutest stars, even such as would be effaced by the slightest terrestrial mist, to be seen through the very centre;—thus, Herschel II. saw a group of 16 and 17 mag. stars through the heart of the comet of Biela in 1832: from this diffused state they present every stage of condensation, including sometimes a sparkling or granulated appearance, up to the aspect of a star, which has occasionally, as in 1744, equalled

Venus in brightness, and been visible to the naked eye in broad noonday, or, as in 1843, blazed out yet more splendidly like a bright white cloud, close to the glowing meridian sun. [Other comets visible by day (omitting some questionable ones):—A.C. 43, the star of "the mightiest Julius," which appeared during the games held soon after his assassination, and gave rise to the star on the forehead in his coins and statues;—1106, 1402, 1577 (Tycho's great comet), 1618. That of Feb. 1847 was seen by Hind, and that of Aug. 1853, by Hartnup and Schmidt very near the sun; but in each case with the telescope, in which they shewed planetary discs. Donati's comet was not visible, except with very powerful instruments, by day.] High powers usually dissolve any apparent solidity, and different instruments may give very different sizes to what looks like a planetary disc, throwing much doubt upon its reality: sometimes a very minute point (as Herschel I. found in 1807 and 1811) holds out against any magnifying; and this—like broader nuclei—is not always central in the head. In some comets (1618, 1652, 1661, 1707, Winnecke's 1869) the nucleus seems to have been composed of separate masses,—a marvellous structure; would that we could study it with modern advantages! Had "the Donati's" nucleus passed about 20′ further N., it would have gone right over Arcturus—and we should have obtained some negative information at any rate as to its composition. Miss Mitchell alone seems to have witnessed the central transit of a comet (1847) over a 5 mag. star, which shone through it unchanged; some minor examples are less conclusive. Were a defined phasis to show itself, a certain amount of density might be inferred; but if we except "the Donati" as seen by Dawes in daylight, Oct. 8, this has never been satisfactorily the case, as the retroverted form often assumed by luminous sectors throws a doubt upon the observations. The darkness close behind the nucleus in 1858, if not real shadow, seemed at least to prove that the nucleus was not permeable to the solar energy, in whatever way exerted, and that it had no rotation upon an axis. The arrival of the next great comet will be a season of absorbing interest. The spectrum analysis, first of Donati, subsequently of Huggins and Secchi, has shown not only the native light of 7 small comets, but, what had been little anticipated, their gaseous character, the comets of Winnecke II., 1868; I., 1871; and of Encke giving a spectrum corresponding with that of the *vapour of carbon*;—a discovery so much the more unexpected, as this element is peculiarly unsusceptible of such a modification. There can now be little doubt that such is the constitution of larger specimens also, but probably with much variety in composition, as the acknowledged difference in colour makes sufficiently evident.

2. The Coma is the sphere of mist around the nucleus, forming, in popular language, the *head*; this is sometimes of considerable extent—2° 40′, or 5 times the moon's diameter, in 1770, when the nearest recorded approach of a nucleus to the earth took place, of 1½ millions of miles. The coma fades away into the surrounding sky, with an outline, including that of the commencing tail, usually considered parabolic; Bond, however, found in 1858 that its section approached much more nearly to a catenary curve. Its denser part, if distinguishable by any set-off or outline, is called

3. The Envelope. This is an interior and brighter layer of mist, suspended as an atmosphere around the nucleus, at least where exposed to the sun. In Donati's comet some observers (amongst them myself) carried it a good way round the back of the nucleus; but usually it turns straight off on each side to form the commencement of the tail: within it is sometimes a darker narrow band, separating it from another interior and brighter envelope. [As to this, Huggins has made the important remark that these non-luminous spaces may correspond to a condition of the vapour too cool to emit light, and yet not condensed so as to reflect it.] In 1858 no fewer than four such dark spaces at once were sometimes shown by the great achromatic at Cambridge, U.S., indicating the consecutive rising of five shining waves, which had spread themselves in succession outwards from the nucleus; the latter seeming to diminish in size and brightness after each of these emissions of luminosity. Madler, at Dorpat, noticed an actual increase of one of these envelopes from 18″ to 27″ in 2h. In 1811 the whole coma and envelope were raised in one parobolic mass from the nucleus, which was surrounded by clear dark sky on every side: when the extreme diameter of the luminous cloud amounted, according to Scroter, to 947,000 miles, considerably exceeding the bulk of the sun, and almost doubling the moon's orbit. As this comet receded, the dark space became indistinct, and the envelope sank finally down upon the nucleus. Envelopes sometimes contain dark spots and streaks (1858), and more frequently brushes or fans of light, where the shining matter seems to stream out from circumscribed portions of the nucleus; these are rapidly variable, and in Halley's comet, at its return in 1835, showed such a libration from side to side, traceable from hour to hour, that Bessel inferred some powerful polar force unconnected with gravity. Such a swinging was less distinctly recognised in 1858. In Comet II., 1862, in which these aigrettes were very striking, Secchi and Chacornac found no motion of this kind, but that the jets proceeded alternately from different parts of the nucleus. The envelope and coma together form the origin of

4. The Tail. This, when not greatly foreshortened, appears as a long cylinder, or more usually cone, widening in general as it advances, and showing a hollow structure by an interior darkness. There seems, however, a doubt of the adequateness of the explanation; since the perspective of 1858 required a very different proportion either of the *breadth*, or the *intensity* of the dark space: some other cause may possibly be combined with vacancy to produce the effect. This interval in the Donati was very dark close behind the nucleus; Schwabe found it darker than the twilight sky, and Dawes and Hartnup considered it *real shadow*: in 1811, however, such a vacancy surrounded the nucleus on every side. The division into two streams effected by it was seen with the naked eye in the great comet of 1577, which astonished Tycho at his fish-pond before sunset, and it has been frequently noticed since the discovery of the telescope; in 1843 it was absent; and a brighter ray filled the middle when Halley's comet, in 1835, was withdrawing from the sun. The preceding stream, according to the comet's motion, is usually brighter and sharper defined, as well as curved backwards. Kepler noticed this in 1618, and compared it in his own graphic way to the appearance of a heap of corn swept over by the wind in the threshing-floor: and no one will forget it who saw the form of the Donati. It has been usually referred to motion through a resisting medium: but Pape, from an elaborate investigation, finds that the curvature may be explained by the combination of the comet's motion with a repellent power in the sun. The axis of the tail was calculated by him to differ 6 deg. 18′ from exact opposition to the sun, being left a little behind;—a deviation of which there have been previous examples. The length of the tail is sometimes enormous. According to Boguslawski, that of the wonderful comet which in 1843 nearly grazed the surface of the sun, and, as Secchi expresses it, issued from it like a dart of light, was cast away to the almost incredible extent of 581 millions of miles—more than 6 times the distance of the earth from the sun, and crossing the orbit of Jupiter: and this astounding stream, the longest object, as far as our senses can reach, in all space, must have been shot out with an equally inconceivable velocity after passing the perihelion; for, but a short time before, the head was on the other side of the sun, half round which it had been whirled in 1½h. or 2h., and under such circumstances the whole direction of the same tail could not be supposed to have been reversed. Even should the length be considered to be overstated, we certainly have before us here oneof the greatest marvels in the universe. Minor trains are occasionally seen; in some cases (1769, 1811) the prolongations of an outer envelope; in others apparently separate branches (1806, 1843); according to Cheseaux, six of them, each hollow, formed a glorious fan in 1744. A straight, long, narrow, and very faint ray of this kind, directly opposite to the sun, was seen by several observers steadily preceding the great curved tail in 1858. The grand visitor of 1861 had a straight and a curved tail, the latter of which probably swept over our globe, or, according to Liais, buried it to a depth of 110,000 leagues. From certain periodical returns of lateral streams, Dunlop, in 1825, inferred a rotation of the tail in 20½h., and similar appearances were noticed in 1769 and 1811, but the explanation is, perhaps, precarious, from the immense velocity required. An additional stream has sometimes, though rarely, been directed *towards* the sun; this extraordinary phænomenon, called an *anomalous tail*, was noticed in 1824, when it was longer and brighter, though narrower and more tapering, than the usual one; subsequently it was found recorded that the grand comet of 1680—Newton's comet—had left a similar glowing wake upon the æther; and it has since been noticed in 1845, 1848 (Encke's,—perhaps again in 1871), 1850, and 1851. The principal tail in 1858 was seen by the Americans crossed obliquely by a number of brighter bands like auroral streamers, diverging from a point between the nucleus and the sun.

A few other details should be noticed. Coruscations, or flashings, have been often remarked in the tail: that of 1556 was said to waver like the flame of a torch in the wind; and numerous other instances might be given, before and since the use of telescopes. The accurate Hook took many precautions before he satisfied himself of their reality in 1680 and 1682, and Schroter stoutly maintained their existence in 1807, referring them to electricity or some analogous cause; others negative them as too rapid for the progressive motion of the light by which we should see them,—an objection, however, applying only to foreshortened tails,—and treat them as illusions depending on our own atmosphere, or the uncertainty of weary sight. Polarization experiments concur with spectrum-analysis in discrediting their reality, by showing that the tails, as well as comæ, shine by reflected light, owing probably, as Huggins suggests, to the cooling of the incandescent material of the nucleus. These researches have of late made a rapid stride. But many points are still very incomprehensible. "Omnia incerta ratione, et in naturæ majestate abdita."

The *colours* of comets differ; a wide margin must be left for the superstition of the ancients, who dreaded the herald of disaster, "terris mutantem regna cometen," and held it as a malignant genius that

—— From his horrid hair
Shakes pestilence and war.

Those who noticed the fiery hue of the sabre-like comet that passed to the E. at the commencement of the Crimean war will understand with what feelings our fathers would have gazed upon it, like the astonished spectators of the comet of the Northern Conquest, represented in the Bayeux tapestry with the inscription "isti mirantur stellam:" nor will the exaggeration of those beautiful lines seem unnatural,

> —liquida si quando nocte cometæ
> Sanguinei lugubre rubent.

It is, however, certain, both from the Chinese and modern observations, that there is much general difference in respect to colour. Herschel I. even found the nucleus of the same comet (1811) pale ruddy, the envelope greenish or bluish green; and a similar contrast was noted by Struve I. in Halley's comet in 1835, and by Winnecke in 1862. That the sun induces in them a polar force superior to that of gravitation—the hypothesis, in the main, of Olbers—is most probable from the form of the envelope and tail, as if repelled alike from the nucleus and sun; and that a certain portion of the rarer material is dissipated during the perihelion passage is evident from the very aspect of a tail such as that of 1858, whose restoration to the rapidly advancing nucleus is, to our apprehension, an impossibility. And in this, and in the destructive resistance which one comet (that of Encke) is known, and all may be presumed, to suffer, from the denser æther around the sun, we find a striking indication that our system was not made to be eternal. The perfect balance of its construction might at first lead to another impression, and seem to countenance the old objection, that "all things continue as they were from the beginning of the creation." But here is evidence to the contrary—a slight but decisive symptom that—"they all shall wax old as doth a garment"—that "they shall be changed." A similar cause has probably been acting upon the comet of Biela; whose separation into two parts is one of the marvels of modern astronomy. Single in all previous observed returns (those of 1772, 1805, 1826, 1832), in 1846 it became elongated, and then threw off a portion which increased till it rivalled, and even for a short time surpassed its parent, each having at one period a starry nucleus and short tail, while they were connected by faint streams of light: and thus they continued in sight for more than three months, keeping a distance of something more than 150,000 miles, the companion being the first to vanish. When next seen by Secchi, in 1852, the distance was more than eight times greater, being 2″ in RA, and 30′ in Declination, as though they were becoming independent bodies: their next favourable return (1866) was looked for with no common interest; but they were not seen, and probably will never again be seen by mortal eye. Nor has the larger comet of De-Vico, discovered by him in 1844, with an apparent period of 5½ years, ever shown itself again. It has—

> —wandered away alone
> No man knows whither.

The identity of the orbits of two comets (II, 1862; and I, 1866, believed to be the same as that of 1366) with the paths of the meteor-showers in August and November is one of the most remarkable of modern discoveries, for which Schiaparelli has recently received the Gold Medal of the Royal Astronomical Society. It is, however, needless, in a treatise like the present, to make more than a passing allusion to a subject of this nature.

General Literature.

Lord Harrie and Leila: a Romance of the Isle of Wight, and other Poems.

By HENRY GEORGE HELLON. London: Provost and Co., 36, Henrietta-street, Covent-garden, W.C. Fcap. 8vo., 290 pp.

DR. JOHNSON'S Prince, in "Rasselas," soon found that he could not be a poet by imitation, and that he must seek the scenes of nature as a field for his imagination and fancy. Pope's prolific genius first exhibited itself in pastoral poetry. Mr. Swinburne is, perhaps, the most original poet of the day; Mr. Morris—whose songs and legends in imitation of Chaucer have met with the applause they justly merit from the readers of poetry—may fail to find a hearing in the future. The world is moving in another vein; originality alone will live, but the laws of poetry will ever remain the same. Nevertheless, at the present time the majority of poets are imitators, imitation, if not too close, being by some considered a safe path as following the style of a great and successful poet. Moreover, imitation is easy to men of ordinary ability.

Now that poetry is taking a high place in literature, and rising from the grave to which it has been doomed for the last fifty years; it is a pleasure to meet with a new singer at the shrine. The poems in the volume before us possess a refreshing originality. Mr. Hellon's genius is varied and healthy; he grasps nature in various forms. This is, undoubtedly, the finest form of poetry; it was from Nature that Byron, Shelley, and Keats drew their inspiration.

The romance, which occupies the greater part of the volume, is full of descriptive scenes, interspersed with songs both grave and gay, founded on the history of the island. The romance is written in nine cantos, two of which are written in the Spenserian or ottavarima stanza, and the remainder chiefly in octosyllabic. The following is worth quoting, as descriptive of a trait in the character of Lord Harrie in boyhood:—

> He loved the ocean—it was his delight
> To watch the glory of its rolling wave;
> Climb the rude rocks where only eagles light;
> Or muse in some secreted, seabound cave,
> Where the tossed billows, wildly foaming, lave,
> And listen to the music of the spray
> As it returned, as glorying to brave
> Another Creature, or in surges play
> Till drawn again, and lost in many shades away.

Our columns do not allow space for satisfactory quotations, or we might quote many verses that would give pleasure to the lover of poetry.

There are many ballads of graphic character; we note two in particular, "Chale Bay" (called in the Doomsday Book "Cela"), and the legend of "St. Boniface and Fair Annie." Mr. Hellon occasionally indulges in a poetical license in rhyme to preserve the rhythm, but this is no serious blemish when compared with some poetry of the present day. We, however, advise Mr. Hellon to steer clear of such licence in future.

Perhaps the most complete of the miscellaneous poems is that in memory of the Prince Consort, which is elegant in language and full of pathos. It is this which has attracted the notice of her Majesty the Queen, who has very graciously accepted a copy of his works from the author.

We note that Mr. Hellon appears fully to understand the composition of heroic or blank verse, and the proper use of the true iambic and spondel. Of all verse this is the most tortured, and a stumbling-block with many. It sometimes falls to us to review verse of eleven, twelve, and even thirteen lines written for blank verse, instead of the true heroic or ten syllable line. We might point to some very popular poetry of the day, now largely read, where this verse is sadly abused—where lines of all character are jumbled into a huge mass of words. Of all poetry extant in this verse, "The Dream," by Byron, is the most perfect.

The sonnets are very elegant, and give great promise. The majority are after the Italian model, with not a few thoughts and fancies. They remind us strongly of Keats, who, no doubt, has an admirer in Mr. Hellon.

Jest and Earnest.

A Collection of Essays and Reviews. By GEORGE WEBBE DASENT, D.C.L. 2 vols. Chapman and Hall.

THERE is a good deal of very pleasant reading in these volumes, and though their contents appeared in some one or other of our periodicals, including the *Times*, they are not the less pleasant on that account in their present form. Many people object to these reproductions, and occasionally, it may be admitted, they come to us when we had rather they had remained where they originally appeared. In this matter, however, they labour under no disadvantage, not belonging to literary efforts which never saw the light, until they come before the world in such colour and form as the taste of the publisher dictated.

We grumble, however, with Mr. Dasent, because he has, to some extent, overdone his work. Most of the essays and reviews now put forth in these volumes are good and pleasant reading, and must have been pronounced so when they first appeared. But there is one called the "Story of Free Trade," after the manner of Herodotus, which is extremely offensive, not only in consequence of the manner in which it deals with the names of some of our most esteemed and honoured statesmen, now no more; but for the objectionabl tone of thought by which it is characterized from beginning to end.

Turning from this to what is pleasanter, we enjoy thoroughly Mr. Dasent's excursion to Faroe, and the strange, because unusual, description he gives of streets, quays, outlying landscapes, and other features, by the people who go about doing their business, taking their pleasure, and filling up the sum of their lives without knowing or caring much about the great outside far-away world, or the lofty ambitions and great affairs by which it is agitated and tormented. We cannot imagine Thorshaven to be a pleasant town to visit in, or to make love in, to be born in, or to die in; and yet, no doubt, the ladies manage to get together, and talk scandal, and speculate on the prospects of the whale fishery, and munch dry fish, whilst the young steal in the evening, through the odour of ancient sea produce, to meet each other with bright eyes and throbbing hearts. If every town cannot be as handsome outwardly as some of the proudest are, the inner life differs far less, and up amongst the whales in Faroe they manage somehow to get on. "The town," says Mr. Dasent, "is built round the rocks which gird the haven, in the hollows eaten by the waves into the trap formation, and not only round, but up and down, in a strange fashion; the streets are narrow, and the houses mostly of wood; all about the place are joints of whale hung up to dry; for that mammal's flesh ekes out many a meal in Faroe—fish, and whale, and mutton, —mutton, whale, and fish,—scale and skin, and skin and scale; so runs the round of life from hour to hour in Faroe." Primitive enough this, and homely to the last degree of homeliness, and the people harmonise in their personal appearance with their surroundings. Mr. Dasent takes leave of one of his distinguished entertainers thus:—"Worthy Sysselmand, how shall we ever repay thee for thy kindness to us? Even now we see thee before us, in thy photograph taken in thy dark velvet jacket with silver buttons, thy tight-fitting hose, and shoe-strings crossed high over the ancle. Member of the Danish Rigsdag, the king's sheriff in Faroe; a man of the simplest manners and most varied knowledge and intelligence; great in whale lore and fowl lore; strong in deep-sea fishing; a great gatherer of strange over-sea waifs; a man who, if he had a chance, would catch the great Auk himself and bring him home alive; who knows all the gulls and their eggs, and has often been over the cliff on the 'rope' to take them."

There is much more in this essay well worth reading, and we could give our readers many an exciting and pleasant passage, but we leave them to search the volumes for themselves, where they will find much concerning Northern lore, as well as Northern life, pleasant and even profitable to be acquainted with. Going from the first essay in the volume to the last, which is entitled "Pickings from Poggio," from which we meant to cull a good story or two, but on looking over them a second time we found that they had all, in some form of disguise, already been made known to the public, and so we leave them untouched for the delectation of the curious reader, who may decide to go to Mr. Dasent's volumes.

STEAM LOCOMOTION ON COMMON ROADS.

By John Head, Assoc. Inst. C.E.

The following is the substance of the paper which was read at the Institution of Civil Engineers, on the 8th of April, 1873:—

The author commenced by reviewing the history of the road locomotive from the time of its introduction, about the year 1827, up to the present time, showing the energy and talent which had been displayed by Gurney, Hancock, Scott Russell, and other of the early inventors between the years 1825 and 1834, and the great difficulties which appeared to beset them in their endeavours to introduce steam on common roads.

It was also shown that a great demand existed for more rapid communication, on account of the increasing traffic which began to be developed about this time in England, and although a great many persons were in favour of improving the traffic on common roads by the use of steam power, it was soon found that although the first outlay for a railway between two towns was much greater than for a service of steam coaches on existing roads, on a scale commensurate with the requirements of the time, yet the iron road laid on a level must in the end prove successful, on account of the difficulties in the latter system of dealing with the increased traffic, the impossibility of manœuvring two carriages, or even one, on a narrow or badly metalled road; and lastly, the common right which every inhabitant of the country had to the turnpike road, in addition to the power possessed by trustees, of fresh metalling the roads and imposing tolls, which were often more per diem than the total cost of running the engine.

These insuperable difficulties had caused the abandonment of steam locomotion on common roads until about the year 1856, when the subject was again revived, with a view to the adaptation of these engines for agricultural purposes, and up to the present time the attention of engineers interested in the subject had been diverted almost entirely from the question of passenger traffic—and to a great extent also from the conveyance of goods—and devoted to the study of agricultural requirements, although during the past two or three years a good deal of attention had been turned to reviving the subject of passenger traffic, not only on common roads, but also for tramways. The use of these engines for military purposes had also claimed serious consideration.

Before commencing a description of the various locomotives, the author took up the consideration of the various driving wheels which have been designed, as they performed the most important functions in the component parts of a traction engine. They might be classed under the heads of elastic, flexible, and rigid.

An "elastic" wheel was understood to be one whose structure was sufficiently resilient to answer the purpose of bearing springs, but the circumference of which did not necessarily deviate from the circular form by the pressure of the tread. A "flexible" wheel was one whose treading face suffered a material change of form as it rolled along, so as to have a large portion of its periphery continually in contact with the ground.

The following table, compiled partly by Lieut. Crompton, and partly from other sources, showed the resistance of smooth rigid wheels, in lbs. per ton, on different surfaces, although in some cases, they appeared rather high:—

On very good pavement .. = 35
,, good macadam ...... = 60
,, ordinary macadam.... = 90
,, newly laid gravel .... = 200
,, soft grass land ...... = 300
,, newly laid metal...... = 440

Descriptions were given of several wheels designed by different makers.

The India-rubber wheel of the late Mr. R. W. Thomson was designed to act as a spring, and also to increase the adhesion through the flattening action of the India-rubber at the tread of the wheel. Mr. Thomson stretched a ring of India-rubber about 5 inches thick round a wheel formed like a drum, allowing the India-rubber to rotate if necessary. In the early experiments it was found that the India-rubber slipped on damp roads and greasy mud, and was also very liable to be damaged by various substances found on the roads. Mr. Thomson, therefore, designed a sort of armour, consisting of flat plates turned over at the edge and joined together by links. This species of armour gave much trouble, owing to the continued breakage of the link pins and the difficulty of keeping the tire in its place, unless the shoes were very tight. Messrs. Aveling and Greig, also Mr. Thomson and Mr. Burrell have much improved these shoes; in the former case this is accomplished by discarding the links and substituting an attachment of the shoes to the rim of the wheel, and in the latter case by allowing the steel plates to touch each other and lap over and clip the angle iron rim of the wheels on both sides. These latter shoes had been found to answer in practice better than the former ones, but up to the present time the experiments had not been of sufficient duration to form any trustworthy data of their permanent success.

The India-rubber tire had the great advantage of being a perfect spring to the engine, and formed a safe and sure break. Its resistance on good macadam was more than a rigid wheel, although on a rough and newly metalled road the flexible wheel had a great advantage, owing to the great surface of its tread. Over paved roads the rubber, or any other flexible wheel, was decidedly superior to the rigid driver, owing to the increased amount of surface of adhesion in the former.

One of the principal drawbacks to the use of India-rubber tires was their great prime cost. The cost of the tires for the "Ravee," built at Ipswich for the Indian Government, amounted to £241; and of the "Sutherland," which was smaller in diameter but of great width, £234.

It was difficult to form any correct formula for the depreciation of these tires, owing to the paucity of the experiments hitherto conducted, and the short time which engines on this patent have been at work. The Duke of Sutherland stated that after running 1,000 miles during 90 days, the India-rubber tires weighing when new 1,337 lbs., were reduced to 1,202 lbs. or about 10 per cent. Mr. C. F. White, of Aberdeen, ran 4,400 miles with his tires in 309 days, and the weight was diminished in this time from 1,267 to 1,133 lbs. or about 10 per cent. The tires have been relined with thin India-rubber and are now working satisfactorily. Lieutenant Crompton wrote from India—"The tires of the driving wheels wear well and are not affected by the heat," and he hoped to run 8,000 miles with a set.

Adam's wheel. This wheel was purely elastic and only acted as a spring to the engine. It consisted of an ordinary centre and arms, having a heavy T iron rim, between which and the outer tire were inserted treading blocks of rubber about two inches thick. These blocks are kept in position by means of two angle irons, rivetted to the outer rim. A drag link connected the outside tire with a T iron ring.

In Bremme's flexible steel tire wheels the flexible tire was formed of one or more rings, and each of these rings was constructed of one or more bands of steel or other similar materials; to the tire were attached an adequate number of arms or links, which made the connection between the tire and central part of the wheel, so that the arms or links projecting a given distance beyond the periphery of the central part were able to support the lateral thrust or pressure which the wheel might be exposed to, and were free to adjust themselves vertically to any curve the elastic tire might assume under a dead load at the axle moving towards the centre.

In the experiments conducted by the Royal Agricultural Society in Wolverhampton in 1871, by Messrs. Bramwell and Easton, with an engine fitted with Thomson's patent India-rubber and smooth cast-iron wheels, of the same width and diameter, and another 10 h.p. road locomotive, with iron driving wheels, with cross bars cast on the rim, it was found that the co-efficient of adhesion of the India-rubber was ·45, that of the large cross-bar wheel of the 10 h.p. engine ·35, and the plain cast-iron wheel ·244, and that the India-rubber tire would take a gross load of five times the insistent weight upon the drivers up an incline of 1 in 18: the cast-iron tires with cross bars 3·75 times the weight on the drivers up the same incline, and the cast-iron solid smooth wheels not more than three times the weight.

With respect to passenger engines, it was stated that Gurney, of London, was the first person who perfected a passenger locomotive which was able to run for hire against a stage coach. The external appearance was like a large mail coach, the cylinders were horizontal, and coupled direct to a pair of 5 feet drivers. The boiler consisted of a net-work of $1\frac{1}{4}$ inch tubes, within which was a fire, the necessary draught being caused by a fan blowing into a close ash-pan. The great defect in this engine was the cranked axle, which continually broke. The boiler tubes also gave much trouble from leakage.

Hancock, of Stratford, was by far the most successful of the numerous steam-coach builders who flourished between the years 1827 and 1834. His engines were self-contained omnibuses, running on four wheels; the cylinders were inverted and geared to the main axle by chains, with a ratio of 2 to 1; the boiler was about 2 feet square and 3 feet high, and filled with flat chambers, connected together, the outer pressure being taken by two strong wrought-iron plates, firmly secured by cross bolts and girders; the draught was kept up by a fan, driven from the crank shaft, discharging into a close ash-pan. This engine ran for some time regularly between the City and Paddington, and three of them were worked for five months on the Paddington Road, running 4,200 miles and carrying 13,000 passengers. The average speed, when out of towns, was about ten miles an hour; but they, at times, attained a speed of twenty miles per hour.

The passenger road engine, designed by Scott Russell, was similar in appearance to a large family coach. The engine had two vertical cylinders, geared 2 to 1 to the driving wheels. The boiler was rectangular, with internal furnaces and return tubes on the same level, like a miniature marine boiler. Behind the engine a sort of two-wheeled cart carried the fuel and water, and formed extra passenger seats. Six of these engines ran between Glasgow and Paisley, in 1834, and carried a large number of passengers at a good speed.

After the year 1838 little or nothing was done with passenger engines until 1871, when Mr. Nairn, of Leith, started a steam omnibus called the "Pioneer," between Edinburgh and Portobello, and several engines had been constructed with Thomson's patent wheels for passenger traffic, the chief of which had been for foreign use. The largest of these were four engines, constructed for the Indian Government, by Messrs. Ransomes, Sims, and Head on the above patent. The cylinders were vertical and placed behind the boiler, which was on the "Field" system, with a very large amount of heating surface. The steersman and stoker were in front of the engine, all the handles for working the engine being alongside the steering wheel.

One of these engines, the "Ravee," made a double journey between Ipswich and Edinburgh in October, 1871, a total distance of 850 miles, which was the most remarkable run ever made by any road locomotive. The average speed was about 6·9 miles per hour for the time actually running, but on several occasions a speed of 15 and even 20 miles an hour was maintained for short distances.

STREET TRAMWAY LOCOMOTIVES FOR PASSENGER TRAFFIC.

Many means had been proposed for propelling street cars, and several of these, such as compressed air, ammonia, and carbonic acid had been actually tried; but although each of these or other plans had been made to perform the functions for which they were designed, and might even be useful under exceptional circumstances, it might be taken for granted that the usual means of working street tramways by mechanical power would be by ordinary steam-engines made and specially adapted to the street traffic.

It was stated that there were only two feasible ways of applying steam power to tramways, 1st, by means of a self-contained steam-car, running upon four or more wheels; and 2ndly, by a detached engine drawing one or more cars.

The first of these systems had been successfully adopted on some lines in America, but it had the objection that the passengers did not like to be in such close proximity to the boiler, and if it were generally adopted the existing tramway companies must purchase entirely new rolling stock. This principle of construction had, however, the advantage in ascending heavy inclines, that the whole weight of the car, engine, and passengers could be utilised for adhesion.

The second system permitted the use of all the existing rolling stock of the present horse tramway companies with but little alteration, besides being more in accordance with the principle adopted on railways, and generally approved of by the travelling public.

It appeared to the author that one of the best street tramway locomotives yet proposed was that designed by Mr. Leonard J. Todd. It was, however, only intended for light traffic. The double cylinders, guides, crank shaft, and gearing were placed in a close box on the top of the boiler. The driving wheels were of the Mansell construction, 6 feet in diameter, and fitted with steel tires. The engine, when drawing a single forty-passenger car, was calculated to give an effective power of 12 h.p., and weighed, when loaded, about 3½ tons. A silent blowing fan of an ingenious construction driven by the exhaust steam was placed in communication with a close ash-pan. This apparatus besides being silent was also self-acting, starting, and stopping with the engine. When going up an incline the back pressure increased and the fan ran fast; when going down hill, the steam being almost shut off, the speed of the fan was very much reduced, and the blast in the firebox diminished.

ROAD LOCOMOTIVES FOR THE CONVEYANCE OF GOODS.

Many engines had been designed for this purpose, but up to the present time few have been used solely for this purpose in England, in consequence of the present state of the Road Locomotive Act, and the difficulties which were always attendant upon the manipulation of a train of waggons on a common road, when it was necessary to uncouple them, or to shunt, or, in fact, to carry out any of the various operations which are always more or less attendant upon the management of several waggons coupled together, except they run upon an iron rail or tramway.

The cost of haulage by steam as reckoned in the the following table, may be considered as approximately correct:—

	Per ton per mile.
Horses on common roads	6d. to 12d.
Steam	3d. ,, 4d.
Horses on tramway, if nearly level	2½d. ,, 3d.
Steam on tramway	1½d. ,, 2d.
Steam on railway	½d. ,, 1d.

Boydell's engine, manufactured by Charles Burrell, of Thetford, the "Steam Elephant," by Taylor, of Birkenhead, and some locomotives by Tennant, of Leith, were amongst the earliest goods engines used in this country; but although they possessed great tractive powers, they were all too heavy and cumbersome to be used economically, and the wear and tear was found to be very great.

Messrs. Aveling and Porter, of Rochester, designed one of the most successful goods engines, about ten years ago, and several of them were at work in this country, although a larger number had been exported to foreign countries.

In the autumn of last year a trial was made with one of Messrs. Aveling and Porter's engines in America, by Professor Thurston, who, in an interesting paper read before the Polytechnic Club of the American Institute, gave the following extract of his experiments:—"The expense account, when doing heavy work on the common road, under the described conditions, by steam power, is less than 25 per centum of the average cost of horse power, as deduced from the total expense of such power in New York State; while, if we take for comparison the lowest estimate that we can find data for in our whole country, we still find the cost of steam power to be but 29 per cent. of the expense of horses. We may state the fact in another way, a steam traction engine, capable of doing the work of 25 horses, may be purchased and worked at as little expense as a team of 6 or 8 horses."

The late Mr. R. W. Thomson, of Edinburgh, also constructed an entirely novel form of road locomotive, which he designated by the name of "Road Steamer," and he was certainly the first to reduce the weight of the traction engine, and to introduce several material improvements which, when modified by experience, would be found beneficial to the progress of steam locomotion on common roads. Mr. Thomson's engines were easy to manage, and were able to draw a large amount in proportion to their weight, owing to the introduction of India-rubber tires on the driving wheels, and, considering the speed at which these engines could run, the machinery was kept in better order through the elasticity of the India-rubber acting as a spring, than in any other system yet adopted.

Messrs. J. Fowler and Co., of Leeds, whose firm was well-known in connection with the steam plough, had also devoted much attention to locomotives for common roads, and their present engine might be considered as one of the best yet designed for the purposes of heavy traffic. Several of these engines were employed in Yorkshire and elsewhere, for transporting coals, minerals, &c., and one of them, fitted with India-rubber wheels, had been continuously at work for some time over paved roads and heavy inclines, in the neighbourhood of Bradford, at a cost of not quite 4½d. per ton per mile, or 11d. per ton the whole distance of 2½ miles, which would have cost, with horses, 2s. 6d.

STEAM ROAD ROLLERS.

These have only been brought into use in England during the last few years, although they have been employed in Paris since 1864.

The rollers hitherto made by Messrs. Aveling and Porter, and generally in use in England, were those weighing about 15 to 20 tons, with driving wheels respectively of 5 ft. and 5½ ft. in diameter.

The working expenses might be calculated at about 15s. per diem, and the number of square yards rolled for the above sum will average 2,000 per diem, but, of course, much depends upon the state of the material to be operated upon. An average of from 10 to 12 yards may be rolled and consolidated for one penny.

After several years' experience with the road rollers hitherto constructed, Mr. Aveling discovered that they were rather too heavy for making new roads, and too broad for narrow or crooked places, in addition to which they were not well adapted for haulage, which was an important feature in the economy of road construction by steam power. He therefore designed a new road roller, which somewhat resembled one of his traction engines, with the driving wheels converted into rollers, and the space between them covered by a pair of front rollers which also act as steering wheels. These front rollers were made conical or dished, in order that on the ground line they may be close together, while above their axle there is a space for a vertical shaft, which serves as a support for the front of the boiler. To the extremities of this axle a forked or saddle piece was attached, to act as a guide for the steering chains, and these chains passed rearwards to a transverse roller, which was acted upon by a worm and pinion connected with the steersman's wheel. By keeping the driving wheels behind instead of in front, as in the engines previously described, the greatest bite was obtained in ascending inclines and going over soft places. Besides being capable of hauling trucks, this engine was furnished with a fly-wheel, and could be used for driving a Blake's stone-breaker, or any other machinery connected with road-making. The weight of the engine was about 8 tons, and the nominal power 5 h.p.

In Paris the "Gellerat" system of steam roller had been employed, which differed materially from that designed by Mr. Aveling, in the position of the rollers; they were 3 ft. 11 in. in diameter and 4 ft. 7 in. wide, and placed under the frame upon which the boiler was supported, and connected to the engine, which was placed on the top of the boiler by means of pitched chains. On the side of the engine where the attachment was made with the crank shaft, the axles turned in radial boxes, fixed to horn plates, similar to an ordinary locomotive, whilst on the other side the axle boxes were free to move backwards and forwards, sliding on the frame of the engine, and connected together by a rod, with a male and female screw, worked from the foot plate by a vertical shaft, connected by bevel wheels with the steersman's handle. When the engine moved in a straight line the axles were kept parallel, but when necessary to turn a corner the centres on one side were drawn together, and, consequently, the rollers acted like a double steering wheel, turning the engine in a very small space.

From the reports of the Road Surveyors in Paris, it appeared that the cost of steam road rolling was estimated at 7d. per ton per mile; whilst horse rolling was usually contracted for at the rate of 14d. per ton per mile.

[This paper will be concluded in our next.]

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LORD RICHARD GROSVENOR, M.P.

Chairman of the Council:

SIR ANTONIO BRADY.

NOTICES.

THURSDAY, MAY 8th.—Patent Law Meeting.
THURSDAY, MAY 22nd.—General Meeting at 4 o'clock p.m.

Monthly Notices.

Deaths of Baron Liebig and Sir W. Tite—Appointment of Professor James Thomson, of Belfast, to chair of Engineering at Glasgow—Another human skeleton found at Mentone—Combustion of the Diamond without excessive heat—Anthropological Institute and Anthropological Society—Puddling oirn by gas from Blast Furnaces—A new indelible ink—Report of Librarian of Radcliffe Library—Luminosity of Sea Water—Pliocene formation in Southern Italy—Utilization of air from the Diving Apparatus—Wood Paper at Bath—*Les Mondes*—*L'Institut*—Pre-historic remains near Madras—Mr. W. H. Johnson on effects of acid on iron and steel—M. Ch. Ekin on Sub-nitrate of Bismuth—Election of M. Janssen as Member of Académie des Sciences de Paris.

The deaths of Baron Liebig, the eminent chemist, and Sir W. Tite, the well-known architect, have been recently announced.

Professor James Thomson, LL.D., of Queen's College, Belfast, eminent for his quantitative calculation of the lowering of the freezing-point of water by pressure, has been appointed Professor of Engineering at Glasgow, to fill up the vacancy occasioned by the decease of the late Professor Macquorn Rankine. The new Professor is the brother of Sir William Thomson.

At Mentone another human skeleton has been found under similar circumstances to those in which human remains were discovered in a limestone cavern in that locality last year.

That excessive heat is not necessary for the combustion of the diamond seems not so certain as generally supposed. Mr. Spence, of Manchester, records that a South African "off-coloured" diamond, the size of a small pea, was embedded in fire-clay, mixed with carbonate of soda and hydrate of lime. This was placed in a crucible, and heated in a muffle, for three days and three nights; and though the temperature maintained was that of a low cherry heat, it was found on opening the mass that the diamond had disappeared.

We are sorry to learn that in consequence of a split-up in the Anthropological Institute, we are to have a London Anthropological Society as well as that Institute. Anthropology, though a most important branch of science, is unfortunately not so popular as to be in a position to support two organizations for its advancement. Rivalry may, it is true, stir up greater activity amongst the promoters of this science; indeed, it seems to be doing so already, since the Institute referred to is reported to have it in contemplation to hold some public and popular meetings, similar to those which were held at the Museum of Geology some years ago.

A description of the process of puddling iron by gas derived from blast furnaces where iron ore is smelted with wood charcoal, which was sometime since patented by M. de Langlade, and is now in operation in France, is published in the *Bulletin de la Société de l'Industrie Minerale.*

An indelible ink, which, it is said, does not prejudicially affect steel pens, is suggested by Dr. Bettger, in *Polytechnische Journal von Dingler*, to be made by rubbing down aniline black in a porcelain mortar with some drops of concentrated hydrochloric acid and alcohol, and afterwards mixing the same with a hot solution of gum arabic, and if this be replaced by shellac an enamel colour for wood or leather is produced.

In the report of the Librarian of the Radcliffe Library (Dr. H. W. Acland) it is suggested that that institution should be made more efficiently to reflect the progress of the higher scientific education. We hope the trustees of the Library will give every attention to the Doctor's advice. Scientific instruction is a great practical question of the day.

The *Athenæum*, in its Science Gossip, observes:—It has been long felt that it is most desirable to have some means of determining with approximate accuracy the per centage of light which penetrates any given depth of sea-water. Dr. Hill has devised a method which was used on board the *Hasler*, which carried Professor Agassiz's Expedition on the recent Coast Survey. The arrangement consisted of a strip of board about four inches wide, and four feet long, divided into a scale of ten equal intervals, and painted a dark lead colour at one end, fading into white at the other—a large white board being fastened parallel to it, at a measured distance below it. The relative whiteness of the boards, when this arrangement is sunk into the sea, is a measure of the per centage of light absorbed, while going down, and up again, through the distance by which the boards are separated.

In the first number of the *Bolletino del R. Comitato Geologica d'Italia* for the new year Prof. G. Seguenza commences an important memoir "On the Pliocene Formation in Southern Italy." This work, illustrated with plates and geological sections, will be continued in succeeding numbers.

M. J. D. Pasteur, of Gennep, has found that the air escaping from the diving apparatus, although unfit for healthful respiration, will still maintain combustion. He has, therefore, constructed a lamp for burning under water, which is supplied with the air which has been used by the diver. The diver wears the lamp attached to his dress and, as it is provided with a parabolic reflector, and the combustion is well supported, the light given is sufficient to read small handwriting under a considerable depth of water.

The manufacture of paper from wood is said to be being carried on with success near Bath.

Les Mondes, for April 3rd, publishes a 'Note relative à l'Observation du Passage de Vénus devant le Soliel au Moyen du Spectroscope," by Father A. Secchi, Director of the Observatory of the Roman College at Rome. Just now this is of considerable interest.

Some curious observations, "Sur la Coloration des Racines Aëriennes de Deux Orchidées," were communicated to the Société Philomathique de Paris, by M. A. Bertrand. This note is published in *L'Institut* of March 26th.

Some interesting discoveries of pre-historic remains near Bellary, in Madras, have recently been made by Mr. Fraser and Mr. Bruce Foot. In the neighbourhood of some large kitchen-middens, great numbers of celts, rubbing-stones and pounders, chiefly of greenstone, have already been found; and it is expected that a careful examination of the middens will yield an unusually rich harvest. One of the refuse heaps, composed of slag and midden-stuff, had previously been described as a volcanic ash-cone!

At the Literary and Philosophical Society of Manchester, some researches on acids in connection with iron and steel, by Mr. W. H. Johnson, showed that the effect of immersion in acid is to increase the weight of the metal and decrease its toughness.

M. Ch. Ekin, in the *Moniteur Scientifique Quesneville*, for February, states, that in many samples of sub-nitrate of bismuth which he examined he detected from 3·9 to 6·5 per cent. of subchloride of silver, and, in other samples, metallic silver in a finely-divided state, though in small quantity.

M. Janssen has been elected a member of the Académie des Sciences de Paris, in the section of Astronomy.

The Inventors' Institute.

At the meeting on April 10th, in the absence of Sir ANTONIO BRADY, Chairman of the Council, Mr. F. H. VARLEY, Member of Council, was voted to the chair. The meeting was, by special arrangement, devoted to the consideration of the action to be taken by the Institute in regard to the forthcoming International Patent Congress in Vienna.

The Chairman having stated that the object of the meeting was to ascertain the views of the members on the important question above referred to, called upon the Secretary, Mr. R. M. LATHAM, to open the discussion of the subject. This he did by stating that the present was a most critical time for inventors, for although, as he had informed the members of the Institute at a former meeting, the Crown Law Officers had stated to him that there was no intention on the part of the Government to attempt to legislate on the Patent Laws during the present Session, yet he had recently learnt that it was now an understood thing that the Lord Chancellor (Lord Selborne, better known as Sir Roundell Palmer) was to bring the subject before the House of Lords forthwith. As his lordship was well known to be a determined opponent of the Patent Laws, it was more than probable that any measure originated by him would be of such a character as to operate on the interests of inventors in an injurious manner. He (Mr. Latham) had, therefore, thought it right to place himself in communication with several well-known Members of Parliament, amongst others Mr. Hinde Palmer, Mr. J. Howard, and Mr. Mundella, who had agreed to come to a conference on the subject with the Council of the Institute on Saturday, the 26th inst., when he hoped all then present would attend. As to the immediate business of the present meeting he would suggest that it had three aspects—(1) The desirability of the Inventors' Institute being represented at the proposed Patent Congress at Vienna; (2) The fit and proper persons to represent the Institute; (3) The instructions to be given to such persons. With regard to the first point he thought all present would agree with him in thinking it most desirable that the Inventors' Institute should be represented at the forthcoming International Patent Congress. As to the second point, he had to state that a well-known member of the Council (Dr. R. H. Collyer), who was going to Vienna as one of the exhibitors, had offered to represent the Institute free of cost, and he need hardly say that Dr. Collyer was well fitted to carry out the duties of the office in an efficient manner. As to the instructions to be given to the representative of the Institute, he felt considerable diffidence in offering any opinion whatever, for, as far as he was aware, the Inventors' Institute had, up to the present moment, never given the subject of International Patent Law any serious consideration, but he would suggest that the question could be settled on the basis that when an inventor had taken out his patent in his own country, it should be *ipso facto* taken out in all countries, subject to the International Patent Law compact, but that all international patents should be subject to the right of any manufacturer to use the patented invention on payment of a royalty of ascertainable amount. In other words, that they should be subjected to what had been termed the compulsory licence system. If the patent laws of all countries could be rendered uniform, that would be a great point gained, provided the law be similar to the Invention Right Bill, prepared by the Inventor's Institute, and the representative of the Inventors' Institute ought not to lose sight of this.

Mr. J. M. HYDE said that the question before the meeting was one of a very grave and important character. He had had great experience in patent matters as an inventor and as a manufacturer, and the result he had now arrived at was, that to attempt to maintain the present position of the inventor as regards his power to shut up his invention against the manufacturers, could not be permanently sustained. He, therefore, considered Mr. Latham's suggestion sound, practicable, and politic, as it would enable the inventor to give way on this point with a good grace; since, as Mr. Latham had aptly remarked, although he gave up some of his privileges, he was to get something very valuable in exchange, namely, an international patent right instead of a merely national one.

Mr. BLANCHETT thought that this subject would have to be very carefully handled at the Conference if any practical good were to result. He was clearly of opinion that the right course would be to settle some general questions, such as those which Mr. Latham had dealt with, and in other respects to leave each country to keep its patent laws in any form it might think desirable. He feared that any attempt to make the patent laws of every country uniform would end in failure.

Mr. F. W. CAMPIN said that he thought Mr. Latham's suggestion was a most valuable one, but, at the same time, before the Inventors' Institute agreed to affirm it, he considered they ought to carefully discuss the effect it might possibly have on the position of a large number of inventors, whose history was of this character;—that when first they sought to introduce their inventions to the public no manufacturer would listen to them, but after they had been able by great perseverance, and considerable outlay, to place the invention in the market, then the manufacturers wanted to have licences which would enable them to destroy the inventor's personal trade, leaving him to depend upon royalties alone; and royalties, it must be remembered, were subject to various difficulties as to estimation and as to collection. Still, he thought compulsory royalties would cut away many of the economist objections to the patent system. To be on the side of caution, he would suggest that in an international system, in the country originating the patent, compulsory licences should not be enforced, at all events, not until half the patent term was completed, and that the licence rate in other countries should not be so low-priced as to enable the licensees there to compete unfairly with the patentee and his licensees in the originating country. With regard to the appointment of Dr. R. H. Collyer as the representative of the Institute at the Vienna Patent Congress, as himself an old member of the Institute he had had many opportunities of knowing Dr. Collyer's worth, and he should have much pleasure in supporting his appointment.

Mr. MURRAY argued strongly against compulsory licences in any shape or form. His experience proved that inventors would be guilty of the most absurd folly in sanctioning such a system.

Mr. TOOTH argued in favour of the system proposed by Mr. Latham, at the same time what had fallen from Mr. Campin impressed him with the idea that the matter ought to be postponed for further consideration.

After some explanatory remarks by Mr. Latham, and by Mr. Campin on the subject of the terms of various foreign patent laws now in operation, and a few words from Mr. GUILE, who stated that he was there to assist the meeting with any suggestions on behalf of the working classes, amongst whom were many men of ingenuity, and speaking in their interest, and as it seemed to him in the interest of the majority of inventors of other classes also, he must say that international patent rights, cheaply obtainable, and open to be used by all manufacturers at ascertained rates of licence money, which it must be remembered would, as Mr. Latham had very properly intimated, act as an invitation to manufacturers to adopt new inventions, be a great boon not only to the particular individuals in the working classes he had named, but to the whole body of working people as well, and he was sure it would greatly benefit everybody irrespective of class,

The CHAIRMAN ably summarised the various statements and arguments which had been presented to the meeting, and then remarked that he had been requested to allow three resolutions to be put to the meeting. The first was:—"That one or more honorary commissioners be appointed to represent this Institution at the forthcoming Patent Congress at the Vienna International Exhibition." This was moved by Mr. Murray, seconded by Mr. Blanchett, put, and carried unanimously.

The second resolution was:—"That Robert Hanham Collyer, M.D., F.C.S., &c., be, and is hereby appointed, one honorary commissioner to represent the Inventors' Institute at the forthcoming International Patent Congress to be held in Vienna in 1873." Proposed by Mr. F. W. Campin, seconded by J. M. Hyde. This resolution, also, was put and carried unanimously.

The third resolution:—"That the drafting of the instructions to be forwarded to the honorary commissioner, or commissioners, be postponed till after the Conference arranged be held on the 26th inst. has taken place." This resolution being proposed by Mr. R. M. Latham, and seconded by Mr. Murray, was likewise put and carried unanimously, and, with a vote of thanks to the chairman, the proceedings terminated.

ANDERSON'S EQUILIBRIO CABIN.

THIS cabin maintains a vertical position when the ship rolls by means of wheels resting on concave rails, whereby it gravitates to the lowest level by its own weight (aided if necessary by ballast placed in a receptacle for that purpose under the flooring), it is guided and preserved in its proper position, centrally over the keel, by pivots fixed to the bulkheads of the recess in which it is placed, which work in vertical grooves attached to the cabin, the latter is thereby prevented from lateral and also from fore and aft movement, and maintained steadily upon its wheels without undue restraint in a vertical direction; the wheels have springs upon their axles to modify the upward and downward motion of the ship, and another purpose of the vertical grooves upon the cabin (in place of sockets) is to allow of free action to the springs.

Access to the cabin is obtained by a doorway immediately over the centre of motion, in front of which is attached a stage or platform, with a gangway platform hinged on either side of it, the other end of which has rollers or runners resting on the deck, these platforms give to the motion of the ship and maintain easy communication with the fixed stage at the entrance of the cabin; a flight of stairs leads from the doorway to the flooring.

In the interior, couches are placed along the sides parallel with the keel, which retain a horizontal position when the ship pitches by means of flanged wheels running upon curved rails attached to a suitable frame, with a clip or catch to retain them on the rails; similar seats may also be placed on the roof, which is reached by stairs from the interior.

The cabin may be constructed of any dimensions, and being self-acting, can be applied to ships making either short or long voyages.

An illustrated description of this cabin and its fittings can be obtained of Messrs. Mitchell, 39, Charing Cross.

Proceedings of Societies.

ROYAL SOCIETY.

March 20.—G. Busk, V.P., in the chair.—The following papers were read:—"On the Distribution of Invertebrata in relation to the Theory of Evolution," by J. D. Macdonald,—"On the Temperature at which Bacteria, Vibriones, and their supposed Germs are killed when immersed in the Fluids or exposed to Heat in a moist State," by Dr. Bastian,—and "Some new Theorems on the Motion of a Body about a fixed Point," by Mr. E. J. Routh.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

Tuesday, April 1, 1873.—Dr. Birch, F.S.A., F.R.S.L., President, in the chair. The following candidates were duly elected Members of the Society:—Rev. William Bramley Moore, M.A.; Rev. Henry Geo. Tomkins. On the recommendation of the Council, and at the request of Mr. Bonomi (acting on their behalf), the surviving Members of the Anglo-Biblical Institute, the Chronological Institute, the Palestine Archæological Association, and the Syro-Egyptian Society, together with their respective libraries and effects, were unanimously incorporated with this Society. The following papers were then read:—1. "On the Religious Belief of the Assyrians," Part III. By Henry Fox Talbot, Esq., D.C.L., F.R.S.—In this paper the learned philologist continued to point out the great similarity which exists between the Biblical and Assyrian styles of writing and expression, illustrating these under the sections of Self-Mutilation, Prostration before superiors, Talismanic Charms, Magical Numbers, Phylacteries, the use of the Mamit, Demoniacal Possession, the Sacred Number Seven (illustrated by the Song of the Seven Spirits, translated from cuneiform texts), &c.; some further observations on the use of the Mamit as a charm, which was to be wrapped in a cloth around the temples of a dying man to expel evil spirits; and some exegetical remarks concluded this very valuable and interesting paper. 2. "On the Identification of Nimrod, from the Assyrian Inscriptions." By Rev. A. H. Sayce, M.A.—In this paper the learned author stated that all the evidence which is at present available, would identify the hero Nimrod with the deity Merodach; on these grounds, 1st, the relation of Assur and Babylon to Nimrod in the Bible, and to Merodach in the inscriptions being the same. 2nd, Merodach being regarded as a hunter, accompanied with divine dogs; and 3rd, Nimrod being identical with the Accadian form of the name Merodach, who is called also in the cuneiform inscriptions "the hero," or "mighty man." 3. "On an Ancient Triple Synchronism—Egyptian, Phœnic-Assyrian, and Greek." By Rev. Basil H. Cooper.—Taking for his starting-point a hieroglyphical tablet which was found a few years ago on the site of Harvaris, the Lower Egyptian stronghold of the Hykshos or Shepherd Kings, dated in the 400th year of an Era, counted from the accession of a king named Sethos or Zethos, whom Mr. C. identified with the founder of Manetho's Seventeenth Dynasty, which is stated to have been Phœnician. By the combined testimony of Conon and Manetho, he proved that this Phœnician dynasty made Egyptian Thebes its capital, and held it for 43 years. Thence it is said to have overrun Asia, and to have planted Thebes in Greece. This latter fact was the historical germ of the myths of Cadmus on the one hand, and of Amphion and Zethos on the other, the divine twins whom Homer makes the founders of Bœotian Thebes. Cadmus is simply the Phœnician word for "the East," just as in the name of his sister Europa we have the Phœnician word Erep "the West," so ingeniously turned into Greek that in that language it denotes literally "the East-facing (land.)" The Homeric legend or *aine* is of a more mythological cast. Amphion, "the Beneficent One," is one of the most sacred names of Osiris, and the lyre with which it is invariably written reminds us at once of the lyre to whose music the walls of the Cadmeia spontaneously arose. Osiris, as Diodorous tells us, was in the Egyptian tradition the founder of the Nilotic metropolis of the Greek city. The twin brother of Osiris was the god Zethos, after whom the Phœnician Pharaoh, as well as several subsequent native ones, *e.g.*, the greater father of Ramses the Great, or Sesostris, were named, and in whose temple at Havaris the 400 year Stela was found. The fact that the Phœnician Pharaoh Sethos was really lord of the East, was proved by the occurrence of his name in Ctesias's list of the kings of Assyria, with a reign of just the same length as is assigned to the Hykshos Sethos, and beginning in the same year. Accordingly his name in cuneiform is met with on a fragmentary royal cylinder in the British Museum, and his hieroglyphical legend enclosed in a Pharaonic ring is engraven on the breast of a lion in grey granite, which was found at Bagdad, and is now in a private collection at Paris.

CHEMICAL SOCIETY.

March 20.—Dr. Frankland, President, in the chair.—Mr. C. W. Siemens delivered his lecture "On Iron and Steel." The lecturer, after adverting to his former discourse, delivered before the Society in 1868, and describing the various experiments he had made to obtain malleable iron direct from the ore, gave an account of the process by which he had succeeded in completely attaining that object. It consists, essentially, in fusing the ore by means of the most intense heat in a revolving furnace, and then adding the requisite amount of carbonaceous matter to reduce the iron to the metallic state. The malleable iron, thus precipitated in the molten mass, becomes aggregated into balls by the revolution of the furnace, and can then be easily removed. It is free from sulphur, phosphorus and other impurities, and dissolves readily in a bath of molten cast iron, producing steel equal to that made from the best Swedish bar iron.

ZOOLOGICAL SOCIETY.

March 18.—The Viscount Waldon, F.R.S., President, in the chair.—The Secretary read a report on the addition to the Society's Menagerie during the month of February. Amongst them was especially noticed a Red Tiger-Cat (*Felis aurata*) from the Gold Coast, presented to the Society by Mr. C. S. Salmon.—A communication was read from Mr. R. B. Watson on some marine Mollusca from Madeira including a new genus of the *Muricidæ*, proposed to be called *Chascax* and a new *Rissoina*, and embracing descriptions of the whole of the *Rissoæ* of the group of islands.—A communication was read from Dr. J. D. Macdonald, F.R.S., on a specimen of *Acanthias vulgaris* and a species of *Galeus*, probably new to science, taken off Flinder's Island, Bass' Straits.—Mr. W. T. Blanford read a paper on the Gazelles of India and Persia. This contained the description of a new species *Gazella fuscifrons*, founded on a single specimen obtained by the author in 1872, near the edge of the desert of Seistan.—A communication was read from Dr. J. S. Bowerbank, F.R.S., containing the fifth part of a series of memoirs entitled Contributions to a General History of the Spongiadæ.—A communication was read from Mr. Herbert Druce, F.Z.S., giving a list of the collections of Diurnal Lepidoptera made by Mr. Lowe, in Borneo, with descriptions of new species. A communication was read from Mr. Gerald Krefft, C.M.Z.S., containing the description of a new species of Crocodile from Queensland, proposed to be called *Crocodilus iohnsoni.*—Mr. Edward Bartlett exhibited and gave the description of a new Moth belonging to the family Saturniidæ, which had been obtained in the interior of Madagascar by Mr. T. Waters, and which was proposed to be called *Tropœa madagascariensis*.

April 1st, 1873.—R. Hudson, Esq., F.RS., Vice-president, in the chair. A communication was read from Dr. J. S. Bowerbank containing a description of the brain and of a portion of the nervous system of *Pediculus capitis*. A communication was read by Dr. J. E. Gray, F.R.S., containing remarks on the genera of Turtles (*Oiacopodes*) and especially on their skeletons and skulls. A second communication from Dr. Gray contained the description of the skull of *Sternothaerus*. Dr. A. Günther, F.R.S., read descriptions of three new species of flying squirrels, proposed to be called *Pteromys tephromelas*, from Penang, *P. phœmelas*, from Borneo, and *Sciuropterus pulverulentus*, from Penang and Malacca. A communication was read from Mr. R. Swinhoe, H. B. M. Consul, Ningpo, on a Scaup duck found in China, which he referred to *Fulix mariloides* (Vigors.) Mr. R. B. Sharpe, F.Z.S., read a paper on the *Falco arcticus* of Holboell, to which were added remarks on the changes of plumage in some other accipitrine birds. Mr. A. G. Butler, F.Z.S., communicated a list of the species of spiders of the genus *Acrosoma*, with descriptions of new species. M. O. Salvin made some remarks on the tail-feathers of the birds of the genus *Momotus*, and on the mode in which their peculiar form had originally arisen. The next meeting of the Society for scientific business will be held at the Society's House, in Hanover-square, on Tuesday, the 6th of May, 1873, at half-past eight o'clock, p.m., when the following communications will be made:—1. Rev. O. P. Cambridge.—On some new species of Araneidea. (Received 15th March, 1873.) 2. Sir Victor Brooke, Bart.—On African Buffaloes. (Received 18th March, 1873.)

GEOGRAPHICAL SOCIETY.

March 24.—Major-General Sir H. C. Rawlinson, President, in the chair.—The following new Fellows were elected:—Capt. H. Busk, Major A. Cathcart, Messrs. R. Galsworthy, H. Hill, A. B. Mitford, G. B. Tipping, H. Wagner, and J. Wonnacott.—The paper read was, "Notes on Khiva, and the Routes leading to that Country," by the President. Khiva, the tract of country south of Lake Aral, fertilized by the Delta channels of the Oxus, was probably one of the earliest settlements of the Aryan race. It seems also to have been the true cradle of Eastern Asiatic science, the date 1304 B.C., claimed by a native scholar for the people of Kharism, according with the date of invention of the Median calendar. It is probable that the invention of a lunar as well as a solar zodiac arose in the same ancient country, and passed thence to China and India. A curious feature in the physical geography of the region is the fluctuation which has taken place in the lower course of the Oxus, the river at one epoch flowing to the Caspian, and at another to the Aral. The stream was gradually deflected from the Caspian to the Aral during the fifth and sixth centuries of our era; and there exists an historical notice of the sea of Kadar, above Urganj, which was fed by the Caspian branch of the Oxus, drying up in the sixth century. From 500 to 1220 A.D., during which the river flowed, as now, into the Aral, the Caspian became, to some extent, desiccated, its waters retiring for a long distance on its eastern shore. After the latter date the river again changed its course into the Caspian, and several fertile districts on the eastern shore of the sea became thereupon submerged. This lasted for 350 years. Between 1575 and 1675 the river again reverted to the Aral, since which no similar alteration has occurred. Regarding the Russian project of again diverting the Oxus waters to the Caspian, and thus creating an uninterrupted water-navigation, *viâ* the Volga and its canals, the Caspian, and the Oxus, from St. Petersbnrg to Afghanistan, the author quoted passages from the work of a recent Russian engineer, showing that though the diversion was practicable, it was impossible that the stream could be a navigable one. The Oxus is a rapidly flowing stream (five to six miles an hour), and silt rapidly accumulates in its canals and side-channels, needing an immense number of labourers to clear them annually. The present population is insufficient for these requirements, notwithstanding that the labour of Persian slaves is employed. In the event of her taking possession of the country, one of Russia's greatest difficulties would be the want of labouring population. The principal roads leading across the vast deserts which surround Khiva were, first, along the western side of the Ural; second, along the eastern side, from Fort No. 1 on the Jaxartes; third, another road a little further east; fourth, from Samarcand and Bokhara; fifth, from Merv; sixth, from the mouth of the Attrek; and, seventh, from Krasnovodsk, on the eastern shore of the Caspian.

ASTRONOMICAL SOCIETY.

March 14.—Prof. Cayley, President, in the chair.—Messrs. J. M'Landsborough and E. B. Knobel were elected Fellows.—The following communications were announced and partly read :—" Meteoric Shower, November 27th, 1872," by Mr. Graham, Capt. Chimmo, and Mr. Forbes,—" New Use of the Altazimuth Diagram," by the Rev. A. Freeman,—" Markings on Venus," by Mr. Wilson,—" On an Instance of Abnormal Refraction," by the Rev. J. Slater,—" On the Eclipses mentioned in the Saxon Chronicle," by the Rev. S. J. Johnson,—" Phenomenon observed at Sea," by Capt. Knevitt,—" On Meridian Marks for Transit Instruments," by Mr. Crossley,—" On the Barometric Error of Clocks," by Messrs. Webster and Denison,—" On Mr. Denison's Compensation for Ditto," by the Rev. Dr. Robinson,—" On the Want of Observations of Jupiter's first Satellite from 1868 to 1872," by Sir G. B. Airy,—" Discovery of Minor Planet 124," by Dr. C. H. J. Peters,—" On the N. A. Values of the Semidiameter of the Sun and Venus in the Calculations of the Transit of Venus," by Mr. Dunkin,—Comparison of the R.A. and N.P.D. of Standard Stars observed at Oxford, with Places founded on the 'Tabulæ reductionum,' " by Dr. Wolfers, — " On the approaching Re-appearance of Biorsen's Comet," and " On the State of Calculations respecting Biéla's Comet," by Mr. Hind,—" Sweeping Ephemerides for Tempel's Comet," by Mr. Bishop,—" A Self-Recording Transit Micrometer," by Rev. S. Perry,—" On the Apparent Projection of Stars on the Moon's Disc," by Mr. Plummer,—" Copy of a Letter from the Astronomer-Royal to the Lords of the Admiralty on the approaching Transit of Venus," by Sir G. B. Airy,—" Observations of Venus collected by the Observing Astronomical Society," by Mr. Denning,—" Ephemeris for Physical Observations of the Moon," by Mr. Marsh,—" The Transit of Venus," 1874, by Mr. Proctor,—" Distribution of Resolvable and Irresolvable Nebulæ," by Mr. Waters,—and Re-discovery of Biéla's Comet, No. 2," by Capt. Tupman.

METEOROLOGICAL SOCIETY.

March 19.—Dr. Tripe, President, in the chair.—Admiral Sir E. Belcher, Messrs. W. F. Denning, E. M. Eaton, R. J. Lecky, J. Rickett, A. Slate, and L. Turtle, were elected Fellows.—Mr. R. H. Scott read a paper " On some Results of Weather Telegraphy." He stated that the information received was insufficient, both in quantity and quality, to give a complete idea of the weather, and showed how any serious extension of the system would entail greatly increased expenditure, citing the very large cost (£50,000 per annum) of the American Signal Service, the most perfect in existence. He drew attention to the frequency of telegraphic errors, and the serious results arising therefrom. He next proceeded to discuss the probability of our deriving benefit from additional reports from Azores, &c., and showed, by actual investigation, that such reports would not be of immediate use to these islands in regard of giving notice of advancing storms. The modes of conveying warnings to ships were next mentioned, and Mr. Scott stated his belief that ultimately Admiral FitzRoy's drum and cones would be adopted, though not, perhaps, with the significations originally attached to them. The results of the comparison of warnings issued with the gales experienced during the past three years was finally given, and it was shown that while in 1870 and 1871 the percentages of success had amounted to 68 and 63 respectively, in the year 1872 this figure had risen to 81 per cent., as 61 per cent. of the warnings had been followed by gales, and 20 per cent. by strong winds, amounting to a slight gale.—Mr. Marriott read a paper " On the Barometric Depression of January 24th, 1872." This depression occurring in the early morning hours, very few observations had been made, but from those at his command, it seemed to have first touched the English coast, near Falmouth, about midnight, and to have passed along the coast to Upwey, which was reached about 3 a.m.; it then took a northerly course, reaching Birmingham by 6 a.m.; after which, its path was over Derbyshire, Nottinghamshire, and Lincolnshire; and it then passed out of the river Humber between 10 and 11 a.m. Mr. Marriott stated, however, that the evidence was insufficient to prove that this was its actual path, or whether it merely passed over England in a north-east by north direction; at a uniform rate of about 30 miles an hour. The lowest readings of the barometer observed were 28.18 in. at 4·30 a.m. at Clifton, and 28.179 in. at 5·20 a.m. at Evesham. The paper, which was accompanied with charts giving the isobars for each hour, concluded with a few remarks on former depressions.

THE INSTITUTION OF CIVIL ENGINEERS.

March 25th, 1873.—T. Hawksley, Esq., President, in the chair. The paper read was on "The Mont Cenis Tunnel," by Mr. Thomas Sopwith, Jun., M. Inst. C.E. This communication might be considered as supplementary to a former paper read in 1864—(Min. Proc. Inst. C.E., vol. xxiii., p. 258)—and described, 1. The tunnel, as completed, with statistics obtained either by actual observation or from the engineers in charge, or from official publications of the Italian Government. 2. The principal changes which had been introduced in the works and machinery underground and at the surface since the summer of 1863. In the summer of 1863, when the works had been 5½ years in progress, about 1-5th of the entire length had been pierced; 7½ years afterwards, at the end of 1870, or about 13 years, dating from the commencement of the works, the entire distance had been traversed. With regard to the tunnel as completed. The advancing gallery from the Bardonnèche, Italian or southern end, was connected with that from the Modane or French end of the tunnel by a bore hole, 3 metres 80 centimetres long, at 4.25 p.m., December, 25th, 1870. The diaphragm of rock was shot away by 5.20 p.m. the following day (Italian time), and Mr. Copello, the engineer in charge at Modane, past from end to end of the tunnel, entering at the French and coming out at the Italian end. There was an error of about 1 foot in level at the meeting of the two galleries, but no appreciable error in direction.

The actual length of the tunnel was 12,233 metres 55 centimetres (7·6017 miles), or about 15 yards more than was previously stated by the author. The following data, which were now accepted as correct, also varied from those he stated previously :—

Modane or north entrance is 3,801 ft. above level of sea; Bardonnèche or south entrance 4,236; summit of tunnel 4,246; summit of section over tunnel 9,527.

There were curved tunnel entrances at each end, which, added to the length of the real tunnel, made the length traversed by the trains 12,846·92 metres, or 7·9806 miles.

In the total length of the tunnel proper (12,233·55 metres), counting from the Modane or northern end southward, the following different rocks were traversed :—

Carbonaceous Schist 2,096·50 metres; Quartz 388·50; Limestone and Dolomite Limestone 355·60; Calcareous Schist 3,392·95; Total metres 12,233·55.

It was expected that the difference of level (435 ft.) between the French and the Italian extremities of the tunnel, would have insured under all circumstances a steady current of fresh air from north to south; but this had not been the case. The ventilation, although not bad enough to incommode passengers, or to impede the present traffic, was such as to render the work of watchmen, rail-layers and others employed in the tunnel, insupportable at times, and with increased traffic, serious difficulty might be experienced. A remedy was being applied by laying a pipe (20 cents.) 8 in. diameter, from end to end of the tunnel, midway between the two lines of rails which would be supplied with compressed air from the Italian end, and which would have cocks at short intervals opened as occasion requires, by the men at work in the tunnel. Shelter places, or niches, 1½ metre broad by 1 metre deep, were provided at the Bardonnèche end, at distances of 50 metres, alternately on the two sides, and at the Modane end in like manner, at distances of 25 metres. At each 1,000 metres there was a lamp-room, 3 metres square. The tunnel was walled, with the exception of about 300 yards on the French side; the side walls were 8½ ft. high, and of stone throughout; the arch on the Italian side was principally constructed of brick, and on the French side of stone; a brick key was used throughout. There are good side paths of flagged stones, 20 in. broad.

Assuming that the conditions as to temperature at Mont Cenis were not materially altered by its elevation above sea-level, and taking a mean of 2 deg. Fahr. as the increase of temperature for each 100 ft., the temperature in the tunnel should be 100 deg. Fahr. higher than what would be observed in a pit sunk from the summit of the section to a depth of about 80 ft. The author believed that the mean temperature which would have been observed in such a pit, if it had been sunk, would have been 50 deg. to 60 deg. Fahr. If these premises were correct, the temperature in the middle of tunnel should have been 150 to 160 deg. Fahr. The temperature of the tunnel was found to be less than was anticipated; that of the rock in the middle, and of springs issuing from it not having exceeded 84 deg. Fahr.

The temperature of the air in the tunnel during the progress of the works varied considerably according to the number of men employed, quantity of gunpowder consumed, and quantity of compressed air supplied. Extracts from observations of temperature kept at Bardonnèche, at different distances from the entrance, were given, and it was stated that, since the completion of the tunnel the temperature of the air had varied from 80 deg. to 90 deg. Fahr.

The author showed by tables the rate of progress made in each year in the galleries from each end, by hand labour and by machine. The greatest progress made in any one month, was in May, 1865, when 392½ ft. were driven, and the least progress, after the successful application of the boring machines, was in April, 1866, when 35 ft. (in quartz) only were driven; both of these statements had reference to the Modane end. Better progress has been made at the Italian than at the French end of the tunnel, partly owing to the rocks being more favourable, and partly to the advanced gallery being one of a smaller size.

The cost was not yet known offiicially; it was supposed, however, to have been about £3,000,000. The author gave in his former paper extracts from the agreement entered into between France and Italy, May 7th, 1862, and an estimate of probable amount which would be due from France to Italy, the Government of the latter country having undertaken the completion of the tunnel. If the conditions of the agreement had not been altered, that estimate (£1,287,200) would be about correct, and should represent approximately the amount to be received by Italy from France, to which, add £520,000 to be paid by the Victor Emmanuel Railway Company; deducting this total, £1,807,200 from the supposed cost, or £3,000,000, the cost to the Italian Government appeared to have been £1,192,800, from which should be further deducted the value of plant, which would probably be turned to useful account in the construction of other tunnels. On December, 21st, 1867, the Italian Government sublet to Messrs. Sommeiller and Grattoni the excavation of the remainder of the tunnel, 4386·90 metres, at the price of 4,617 francs (£184 5s. 6d.) per lineal metre of completed tunnel.

The following changes had been introduced in the conduct of the works since 1864. In June, 1863, when 1,092·25 metres had been driven from the north, and 1,450 metres from the south end, there were no means actually adopted for ventilation, further than the admission of compressed air by means of cocks, from the supply-pipe, and from that afforded by the large quantity of air exhausted from the perforators in the forehead of the advanced gallery. In 1864 a brattice was placed from each entrance, dividing the tunnel horizontally, as far as the walling of the tunnel was completed, the air from the entrance passing along the under side, and returning along the upper side. At Bardonnèche the draft was stimulated by the return air being taken up in a conduit to a chimney, the top of which was not less than 300 ft. above the level of the tunnel; this being found insufficient, a fan about 32 ft. in diameter, was successfully used to stimulate the draught. At the north end it was found necessary to apply powerful exhausting pumps to extract the vitiated air. By their means fair ventilation was obtained during the prosecution of the works.

Hand labour was found insufficient for the enlargement of the advanced gallery. It was found also insufficient to carry away the rock extracted. In 1868, therefore, the machine perforators were applied for this purpose, at an increased cost as compared with manual labour, but with great success in advancing the rate of progress. Water column compressors were used at first, but the breakages being frequent and the duty performed unsatisfactory, pumps worked by water power were substituted, and gave excellent results up to the time the works were completed.

The alterations made since 1864 in the "perforators," were described. They were simpler in construction, better balanced, and require less repairs than formerly.

The principal dimensions of the perforator now in use were nearly as follows:—

Motor.—Diameter of piston 2·638 in.; area 5·4556 sq. in.; effective pressure, deducting back pressure 69 lbs. the sq. in.; length of stroke 2·834 in., equal 0·236 foot.

Percussion Cylinder. — Diameter of piston 3 in.; area 7·068 sq. in.; effective area, deducting annular space or counter pressure 4·374 sq. in.; average length of stroke 8 in., equal 0·666 foot.

Supposing the percussion machine to make 250 strokes per minute (or the motor 250 revolutions), the power developed is 1·35 h.p. in the latter and 2·46 h.p. in the percussion cylinder, and the quantity of compressed air amounted to 12·662 cubic feet per minute.

The author had not obtained information on the duty performed by the compressors; it is probable, however, the production of 12·662 cubic feet of air compressed to 6 atmospheres, or 5 above atmospheric pressure would require, with good machinery, about 14 h.p.

The different operations of boring, charging, firing, and removing the rubbish were, in the last two or three years, performed with great celerity, and three complete shifts or repetitions of each operation were worked in 24 hours. The strong doors formerly employed, fixed from 100 to 150 metres from the forehead of the gallery, and removed from time to time as it advanced, behind which the frame carrying the set of perforators was removed previous to the explosion of the holes bored, were suppressed, and the saving of time thus obtained more than compensated the occasional damage done by loose pieces of rock which came in contact with the machinery. The author was informed by the *employés*, that supposing 20 perforators were required for the current work, a stock of 80 was sufficient to insure at all times a supply of them in thorough repair.

Upwards of 4,000 men were latterly employed.

Notwithstanding the great cost which was said to have attended the construction of this great work, amounting, if the total figure of £3,000,000 were correct, to £206 per lineal yard, there was reason to suppose that, with the experience now acquired, a similar work could be performed at a cost of £100 per yard.

The time occupied in passing through the tunnel by the train was about 25 minutes.

At the ballot of March 4, 1873, the following candidates were declared duly elected:—Messrs. J. Bennett, G. J. H. Glinn, and R. Harris as Members; and Messrs. J. Barker, T. H. Blakesley, Stud. Inst. C.E., P. Carpenter, S. B. Darwin, E. Giles, F. W. Joseph, Lieut. B.S.C., W. H. King, Stud. Inst. C.E., C. E. Nicholas, F. J. Odling, Stud. Inst. C.E., A. Ricketts, R. E. Speakman, T. S. Stooke, G. Thompson, Colonel J. S. Trevor, R.E., Messrs. J. Whittingham, and G. H. Wood, as Associates.

It was announced that the Council, acting under the provisions of the bye-laws, had transferred Mr. W. Francis from the class of Associate to that of Member; and had admitted Messrs. A. M. Heaton, T. G. Bond, F. F. Buckham, M. Martindale and E. Thompson as Students of the Institution.

At the Ballot of April 1, 1873, the following candidates were declared duly elected:—Mr. C. H. Beloe as a Member; and Messrs. C. B. Braham, Stud. Inst. C.E., R. Davis, F. Fitzjames, F. W. Hartley, T. F. Harvey, J. W. Hill, R. J. Hutton, T. F. Parkes, Stud. Inst. C.E., A. W. Parry, F. M. Pratt, J. S. Statter, and C. E. Ware, as Associates.

It was announced that the Council, acting under the provisions of the Bye Laws, had transferred Messrs. E. S. Currey and T. W. Dodds from Associates to Members; and had admitted Messrs. F. C. de M. Cardozo, H. Gordon, J. M. Small, A. Stark, B. J. Thomas, C. H. Wilson, and J. P. Woodcock, as Students of the Institution.

INSTITUTION OF NAVAL ARCHITECTS.

Session, 1873.—The programme of proceeding of this Institution included (Thursday, April 3rd):—1. Annual Report of the Council. 2. Address by the President (Right Hon. Sir J. S. Pakington, Bart., M.P., and on papers—1. "The Unmasted Seagoing Ships, *Devastation*, *Thunderer*, *Fury*, and *Peter the Great*." By Nathaniel Barnaby, Esq., Chief Naval Architect of the Royal Navy, Member of Council. 2. "The Loaddraught of Steamers." By W. W. Rundell, Esq., Secretary to the Liverpool Underwriters' Association, and to the Underwriters' Registry for Iron Vessels, Associate. 3. "On the Overloading of Steamers." By J. Wigham Richardson, Esq., Associate. 4. "An Investigation of various Proposals for fixing the Load-line of Vessels." By Edward Withy, Esq., Member. 5. "On a Case not provided for in the Admiralty Regulations for Preventing Collisions at Sea." By James R. Napier, Esq., F.R.S., Member of Council.

(Evening Meeting.)

1. "On Auxiliary Power for Ocean Navigation." By Henry Claughton, Esq., Member. 2. "The Causes of the Racing of the Engines of Screw Steamers, investigated theoretically and by experiment." By Osborne Reynolds, Esq., M.A., Professor of Civil Engineering in Owen's College, Manchester. 3. "On a Nonradiating Steam Engine." By Thomas Moy, Esq., Associate. 4. "A new form of the Safety Valve." By W. Babington, Esq.

(Friday, April 4.)

1. "Description of an Instrument for Automatically Recording the Rolling of Ships." By William Froude, Esq., F.R.S., Vice-President. 2. "The Rig of Iron-clad War Ships." By H. D. P. Cunningham, Esq., R.N., Associate. 3. "On Vessels for the Channel Service." By John Grantham, Esq., Member of the Council. 4. "On Water-tight Bulkheads." By Laurence Hill, Esq., Associate. 5. "On Water and Fire-tight Compartments." By Thomas Moy, Esq., Associate.

(Evening Meeting.)

1. "Remarks on the Theory of the Rudder." By Herr Victor Lutschaunig, Professor of Theoretical and Practical Shipbuilding in the Imperial and Royal Naval and Commercial Academy of Trieste, Member. 2. "On the Relation of Frame-space and Shift of Butts to the Butt-fastenings of the Skin-plating of Iron Ships." By W. H. White, Esq., Fellow and late Student of the Royal School of Naval Architecture and Marine Engineering, Member. 3. "A new Hydraulic Steering Gear." By John S. Gisborne, Esq. 4. "Memoir on the Experimental Study of Waves." By Monsieur Emil Bertin, Knight of the Legion of Honour, Secretary of the Society of Natural Science at Cherbourg. 5. "The Designing of Yachts." By C. B. van Denser, Esq., New York. 6. "The Resistance of Ships." By C. B. van Denser, Esq., New York. 7. "On Waves in Liquids." By the late W. J. M. Rankine, Esq., F.R.S., Associate Member of Council.

(Saturday, April 5.)

1. "On Boat-lowering and Disengaging Apparatus." By F. J. Sweeting, Esq. 2. "On Lowering Boats at Sea." By Lieut. May, late E. I. Company's Service. 4. "On an Instrument for Extinguishing Fires in Ships." By James Paton, Esq., M.D. 5. "A Proposed Torpedo Catcher." By W. E. Seccombe, Esq., Examiner of Dockyard Work to the Admiralty, Member.

It is believed that the time is not far distant when pig-iron will be commonly brought as ballast by ships crossing from America to Great Britain; that a large trade of this kind would have commenced already had American politicians been more philosophical and less political; had they studied the first principles of Political Economy.—*Iron*.

IMPROVED STEERING APPARATUS.

Henry Edward Lester, of the Victoria Docks, in the county of Essex, master shipwright, has recently specified his patent for some important improvements in steering apparatus for vessels.

In suitable framework, mounted on an iron or other foundation plate, bolted to the deck of the vessel, either aft or amidships, or, if desired, both aft and amidships, he arranges a double chain drum, one chain coming from underneath the drum in one direction, the other from underneath the drum in the other direction.

Around the drum, preferably in the centre, between the two grooves in which the chains run, is a cog-wheel, into the upper edge of which take two or more small cog-wheels, the axles of which latter work in the same framework as that of the drum.

These two or more small cog-wheels take again into another cog-wheel mounted higher up in the framework, and this wheel is made large or small according to whether it is desired to revolve the drum quickly or slowly; said revolution being effected by means of the ordinary steering wheel or wheels fixed on the axle end or ends of the last-named cog-wheel.

The chains, after passing from the under side of the drum in opposite directions, are run on pulleys or sheaves to the tiller in the usual manner. A bell gong or similar alarum fixed on the framework of the apparatus is struck each time the rudder is amidships or perfectly straight. A cramp is fitted to the latter for the purpose of taking the above chains, which obviate the necessity of unshipping tiller for alterations.

By means of this improved double-action steering apparatus, it is possible to bring a vessel completely round in much less time and with less labour than heretofore.

E. C. C. SEWAGE PROCESS.

This method of utilizing the excrementative refuse of our towns has just been brought under our notice. It appears to be the subject of two patents, one for collecting and disinfecting urine and fecal matter separately, and the other for apparatus for extracting the valuable constituents of the same. The process may be briefly explained as follows:—Urine and fecal matter are collected separately by the E. C. C. container; the fecal matter, which is first deodorized at the closet by being covered at each operation with a mixture of sawdust and soot, is afterwards, on being removed to the works, mixed with a small quantity of coal tar, and passed through a disintegrating machine, and moulded into blocks or bricks, which, after being air-dried, are to be used as fuel at the works for the purpose of extracting the ammonia from the urine by means of heat and lime in an improved still or apparatus very similar to that used for the ammoniacal gas liquors. The effluent water from the boilers being freed from its ammonia, but still containing, with the refuse lime, other fertilising salts, is then filtered and run off in a perfectly inocuous state into the drains. By the above process not only is the remarkable heating power of fecal matter utilised by being burnt in a close and special furnace, but the fertilising salts are regained in the ash in a condensed and most soluble form. The ammonia, which is the most valuable constituent of urine, is, therefore, extracted by means of this artificial fuel composed of fecal matter, sawdust, soot, and coal tar, at a very reduced cost when compared with the ordinary evaporating process, and also that lately adopted by the Towns Manure Company. Theoretically, it is calculated that there is sufficient carbon, or heating power, in dried fecal matter to extract the whole of the ammonia produced by the liquid voidings of a general population, but even supposing that a small quantity of extra fuel be required, the saving in this important item will be immense. The whole process being conducted in hermetically closed apparatus, cannot give rise to unpleasant smells, and the basculi tilting seat for distributing the sawdust and soot, or fuel disinfectant at the closets, appears of a sufficiently simple construction to permit its being purchased and used by the lower class, a desideratum which the inventors of dry closets and commodes, with their weights, levers, and springs, have not sufficiently taken into consideration. The practical experience which the inventor, Mr. F. Target, C.E., has had in sanitary engineering, promises well for the success of this remarkable scientific and ingenious plan by which the inexhaustible and fertilising produce of our large centres of population is to be condensed into a small volume.

RENSHAW'S IMPROVEMENTS IN RAILWAY BRAKES AND SIGNALLING APPARATUS.

This invention is one of great ingenuity and practical importance, mainly relating to the application of the partial vacuum produced by a steam jet supplied from the boiler of the locomotive attached to the train to retard or stop the motion of the several carriages by means of communicating pipes and suitable mechanism; also to the means of preventing the overheating of the brake blocks, when composed of metal, and, in addition, to a system of enclosed tubes or pipes applicable to intercommunication by signals between the guard, driver, and passengers.

In carrying out this invention the inventor fixes a pipe longitudinally on the top of each and every carriage to which his system of continuous brakes is to be applied, such arrangement of pipes being articulated and connected by means of buffer joints or flexible communications between the several carriages in such manner that a free passage for the air enclosed within such pipes is maintained throughout the train, the said joints or flexible communications being sufficiently air-tight to allow of a partial vacuum being produced and kept within the said pipes at pleasure. This system of pipes communicates, and is in connection at the front end, with a steam jet supplied by the boiler of the locomotive, and also with a series of small cylinders, each having a suitable piston attached to a rod operating by means of lever gear the brake of its own carriage in such manner that when the steam jet is turned on by means of a cock or valve under the control of the driver, a partial vacuum is produced within the said system of pipes and cylinders with pistons, owing to the enclosed air being driven out by the issuing steam, and the said pistons are so forced into the said cylinders by the weight of the external atmosphere, and the connected brake mechanism is so operated as to apply the brake blocks to the wheels to retard or stop the train. And when cast iron, or other metallic brake blocks, are used, a cavity is formed within such blocks, and such cavity is placed in connection with a cistern or reservoir of cold water by means of flexible pipes or tubes, thereby causing a circulation of the said water when the said blocks become heated, and tending to keep them cool.

A system of automatic valves enables the brakes to be operated if a portion of the train becomes disconnected by failure of the ordinary couplings, and a smaller system of pipes or tubes may be carried within the aforesaid and larger series for the purposes of intercommunication by signals between the guard, driver, and passengers in such manner that the joints of the two systems may be connected and disconnected at the articulations together, and at the same time.

APPLICATIONS FOR PATENTS.

[Continued from Page 2.

neys.—W. R. Lake. Stay bolt for steam boilers (com. by J. Cochrane).—J. K. Tullis. Dressing leather and the machinery or apparatus employed therefor.—J. Wood. Axles and axleboxes.—A. W. C. Williams. Machinery for manufacturing screws (com. by J. A. Ayres).—J. F. A. Gillon and P. J. Dujardin. Special arrangements of rolling mills with three cylinders.—R. Gigodot. Mode of and apparatus for ventilating furnaces of steam boilers.—A. M. Clark. Machine for sewing leather and other heavy fabrics (com. by J. Boyle).—D. Francis. A desk, a seat, and a table.

On March 20th.—1029 to 1050.—W. R. Jolley. Life rafts applicable to ships and other sea-going vessels.—T. Bevington. Improvements in gloves and in means or appliances for securing the cuff or end to the wrist.—J. W. Lea. Improvements in shirts and similar under-garments for gentlemen's wear.—W. Grange. Common road and tramway cars, and in the mode of applying the same.—R. Morris. Boots and shoes, and loose socks and clogs to be used therewith.—C. Stubbs. Apparatus for heating brine in the manufacture of salt.—F. Fleming and J. Milner. Apparatus for flattening or shaping wire to be used in the manufacture of wire cards and reed wires for looms for weaving.—H. A. Bonneville. Machinery for corking bottles (com. from J. A. de Mestre).—J. W. A. Taylor. Construction of fire-places specially adapted for economizing fuel and diffusing heat.—A. T. Allcock. Rotatory wood-cutting machines for making laths, cards, strips, and sheets of wood.—A. Heaven. Manufacture of table-covers and covers for other articles of furniture.—E. Booth. Pin or pirn winding machines.—J. L. Clarke. Means and apparatus for fitting candles to candlesticks.—H. Jones. Cork life-belts for preserving life at sea.—N. Athow. Production of colours for dyeing, printing, and staining.—E. E. Pearse. Manufacture of glucose or grape sugar from rice and other grain, and in apparatus employed therein.—G. Spencer and W. M. Smith. Parts of locomotive engines, carriages, and waggons for railways and tramways, parts of which may be used for other purposes.—I. Baggs. Manufacture of gas for illuminating and other purposes.—H. H. Doty. Burners for railway and other lamps.—G. Beadon. Apparatus for saving life from drowning, which apparatus may be used for other purposes.—J. Thomas and H. L. Morris. Cleaning or finishing metal plates after they have been coated with tin or other metals or alloys.—T. C. Townsend. Machinery or apparatus for raising or lifting the permanent way of railways, and for lifting and pressing for various purposes (com. by L. C. B. Michel).—W. R. Lake. Apparatus for supplying locomotive tenders with water (com. by W. E. Prall).

On March 21st.—1,052 to 1,069.—J. H. Read. Pegging machines for pegging boots and shoes or similar articles. (Complete specification.)—J. Towlson. Machinery or apparatus for decorticating and cleaning grain.—J. W. Gray. Paving-blocks or flaggs (com. by C. F. Sebille).—P. Jensen. Manures (com. by E. J. Erichsen).—R. Young. Manufacture of shirts, fronts, and articles of a similar nature.—W. Morgan-Brown. Combination or permutation padlocks, either alone or in adaptation to locks of any usual construction (com. by H. Count von Seilern).—J. Wain. Mules for spinning and doubling.—T. H. Forrest. Steam pumps.—H. J. Fairchild. Pressure gauge (com. by J. W. Stiles).—H. Heinmann. Apparatus for utilizing the exhaust steam of steam engines.—L. Van Laak and J. Gillespie. Bungs and bung inserters.—G. B. Palmer. Ball valves.—W. E. Newton. Fog signals for railways (com. by F. D. Ruggieri).—D. Gilbert. Buttons.—E. W. Jobson. Apparatus for controlling the supply of water to water-closets, urinals, and such like places, and in effecting the measurement of the water supplied for such and other purposes.—I. L. Pulvermacher. Means of and appliances for the application of magnetism in connection with electricity for curative purposes.—M. Alex. Apparatus for lowering ships' boats.—F. Healy. Construction of machinery for raising and treating peat, and for the manufacture of the same into fuel.

On March 22nd.—1,070 to 1,076.—H. Martin. Manufacture of concrete and other bricks, by means of a machine worked on the lever principle, and arranged thoroughout so as not to be costly in its construction.—R. W. Attwood. Hydraulic motive-power machine.—C. W. Harrison. Apparatus for charging or impregnating atmospheric air with the vapour of hydrocarbon liquids.—P. Jensen. Construction and arrangement of coke ovens, and of salt evaporating pans heated therefrom (com. by E. J. Erichsen and J. G. Maardt).—J. Nixon and J. Winterbotham. Rolling of steel used in the manufacture of blades for table knives, carving knives, bread knives, butchers' knives, spear knives, swords, matchets, and other such articles. —C. Parkinson. Machinery for beaming or warping yarn.—H. Bessemer. Apparatus to be employed on board ship for controlling, regulating, and indicating the motions of suspended saloons, floors, or platforms, applicable also for the discharge of marine artillery.

On March 24th.—1077 to 1091.—J. J. Myers. Method of removing and neutralizing noxious smells in dwelling-houses and other buildings arising from waterclosets, drains, dead wells, sewers, and sinks, by assisting the sewer gases therein to escape outside the buildings, and facilitating the ingress of atmospheric air into and for the purpose of ventilating the sewer pipes and their several connections.—T. Laycock and J. Shuttleworth. Construction of spools, reels, discs, and tubes for sewing machine shuttles, also the apparatus for winding the thread thereon. (Complete specification.)—D. Smith. Construction of railway permanent way. (Complete specification.)—H. Henkel. Breech-loading fire-arms (com. by Messieurs Dresse, Lalon, and Company).—M. Tobin. Improved means or mode of ventilating rooms or apartments, and the apparatus employed therefor, part of which invention provides a greater security against burglars. — T. P. Moorwood. Improved construction of domestic fire stove for economizing fuel and producing a better radiation of heat.—W. Lawrence. Apparatus for cooling and for heating liquids and for condensing vapours.—J. Cocker. Improvements in self-acting mules for spinning and doubling.—W. E. Potter. Improved fastening for holding the cords of window blinds.—H. Skoines. Combined apparatus for manufacturing gas for lighting, heating, and cooking.—F. T. Krauth. Escapements for watches and other time-keepers. — B. Hewitt and S. Goff. Apparatus for raising and lowering weights or heavy bodies.—J. H. Johnson. Steam generators (com. by L. M. T. Riot and P. Roux.—A. M. Clark. Combined apparatus for sawing mitres and bevels, obtaining levels and determining angles (com. by J. H. Carpenter).—J. G. Tongue. Musical instruments named the "pyrohone" (com. by G. E. F. Kuaster.

On March 25th.—1092 to 1107.—J. G. Lawrie. Docking of ships, or the getting of them out of water for cleaning or repairs.—J. Kilner and S. C. Triston. Handles and scales of butchers' and dagger knives, and other similar articles.—The Baron T. de Mouncie. Machinery for cutting wood.—J. James and S. Burden. Machinery for gathering and tying wheat and other cereals in the field, and part of which may be applied to a reaping machine.—H. Hughes. Improved means of and appliances for marking, creasing, and cutting textile-fabrics, for facilitating the sewing or the placing of devices thereon, such appliances being also applicable for marking, creasing, and cutting papers and metals.—S. Sampson. Rotary and multiplicate printing and numbering machine.—W. H. Wise. Furnaces for generating steam, or for other purposes.—T. Blundell, G. T. Blundell, and J. W. Blundell. Waterclosets of improved construction. (Complete Specification.)—J. McElroy. Slide valve gear of steam engines.—W. C. Fay. Machinery for treating fibrous plants or substances (com. by W. Shedd). (Complete specification.)—S. Lawson. Carriage axles and axle-boxes.—H. Holden. Carriage axles and axle-boxes.—F. Brampton. Fire grates or stoves for warming apartments.—E. C. Vickers. Preparation and treatment of paper to be used as a substitute for leather.—A. M. Clark. Manufacture and preservation of beer, and the treatment of yeast and wort, together with apparatus for the same (com. by L. Pasteur.)—J. H. Johnson. Devices for threading needles (com. by G. P. Farmer).

On March 26th.—1108 to 1131.—R. F. Fairlie. Trucks or bogies for railway (com. by G. Dixon.) —T. A. Nield. Fuel economisers adapted to be employed in the heating of feed water for steam generators.—M. Vickers. Machinery or apparatus for producing motive power.—W. Morgan-Brown. Manufacture of hydraulic hose and machinery for that purpose (com. by E. P. Richardson.)—A. C. Sonntag. Platforms of railway stations for preventing accidents to passengers entering or alighting from railway carriages.—L. McDonald and M. Lenehan. Machine for harrowing, rolling, and sowing corn and seeds.—J. Goettler. Keyless watches (com. by O. Courvoisier.)—T. Maxted. Fuel and manufacture thereof.—J. E. Dowson. tramways (partly com. by A. Dowson.)—J. Bracewell and W. Pennett. Means or method employed for staining or producing on work or other surfaces imitations of inlaid wood, also for producing designs of any other character or colour on such surfaces.—W. E. Gedge. Apparatus or 'twisster-whisk' for drawing, spinning, reeling, rolling up, turning or twisting, and doubling all textiles generally, and particularly for drawing and throwing every description and kind of silk (com. by L. Rocheblave, sen.)—F. A. Woodcock. Preparation of india-rubber. — G. H. Dana. Manufacture of flour for separating the bran and other dark-coloured portions from the white or farinaceous portions of sharps or middlings (com. by G. T. Smith).—C. Roberts, F.R.C.S. Preparation of powders for the destruction of animal and vegetable parasites, applicable also as disinfectants and deodorisers.—M. Williams. Apparatus for burning liquid fuel.—E. T. Moody. Manufacture of illuminating gas.—J. J. Harvey. Apparatus for washing bottles.—J. Shuttleworth. Steam boilers and furnaces.—J. Hamilton. Sewing machines. —B. Harlow. Wringing, mangling, and washing machinery, part of which is applicable to other purposes.—R. Fielden, jun., and T. Fielden. Construction of pickers.—H. B. Barlow. Pneumatic pumps (com. by N. J. Galland).—H. B. Barlow. Process for cleansing or purifying casks (com. by N. J. Galland).—M. I. Landau. Miners' safety lamps and other lamps, and apparatus for lighting, also furnaces, fire-places, and stoves or apparatus for heating, and instruments for kindling lights, parts of the improvements being applicable for ventilating.

On March 27th.—1132 to 1154.—R. Sedgewick and H. H. Lake. Apparatus for preventing fraud by the conductors or other persons in charge of omnibuses and other public conveyances.—W. Stratford. Furnace grates.—S. Edwards. Lawnmowers or machines for cutting grass.—F. Wirth. Steel rails (com. by F. Asthoewer).—J. Owen. Apparatus to be used for the purpose of passing the thread of the weft through the eye of the shuttle in shuttles to be used in manufacturing.—J. L. Nancarrow. Roofing and tiles for the same. —G. R. Hay. Manufacture of wheaten flour. —T. McDonald. Wrappers or envelopes for seed crushing.—R. Lister. [Improved] screw propeller for ships or vessels and improved machinery or apparatus for making the same. —S. Alley. Wheels.—C. Thackeray. Means for securing metal nuts on bolts.—W. E. Gedge. Improved photographic monocular with multiplicity of views, termed the magic circle (com. by A. C. Dallemagne and L. Triboult. H. Cockney and F. C. Cockney. Grates or stoves for the heating of air and economising the consumption of fuel.—E. Shaw and G. Hunter. Boilers.—W. R. McKaig and J. C. Stitt. Floating baths.—E. Heyworth and N. Wilkinson. Steam boilers.—H. A. Bonneville. Presses for cotton and other articles. (com. by B. G. Martin). (Complete specification.) —G. W. Rendel. Hydraulic machinery for working ordnance.—J. H. Johnson. Treatment of certain vegetable fibrous substances and the application of the same to the manufacture of spun or twisted threads or cords, and also to the manufacture of paper and cardboard (com. by I. T. Vignolo).—J. H Johnson. Drawing rollers of spinning mules (com. by M. Passieux).—E. N. Lacroix. Machines for separating and purifying middlings.—A. V. Newton. Mode of and apparatus for manufacturing railroad and other picks, adzes, shovels, hoes, and similar tools (com. by H. L. Lowman). G. H. Babcock and S. Wilcox. Steam boilers. (Complete specification.)

On March 28th.—1155 to 1167.—C. Sellers and W. H. Richardson. Improvement in stoves.—T. W. Kennard. Aquaria and apparatus connected therewith.—H. J. Haddan. Manufacture and use of fasteners suitable for straps, bands, and such like (com. by J. Fairman).—J. H. West. Machinery or apparatus for refrigerating or producing cold for the manufacture of ice and other purposes.—H. S. K. Bellairs. Turning over the leaves of music.—A. Davies. Dampers for furnaces.—W. J. Barber. Boot and shoe toe-pieces or tips.—J. Liebert. Treatment and application of substances not hitherto used as a substitute for chicory, for admixture with coffee, and other purposes for which chicory is used.—J. Morrison. Machinery for propelling steam launches and other twin-screw vessels.—J. Bullows and A. Bullows. Apparatus for clipping horses and other animals.—J. Williams. Apparatus for feeding sheep and other animals.—J. Harrop. Machinery or apparatus for the manufacture of what is commonly called india-rubber hose and india-rubber piping, and other tubular articles composed of similar materials.—J. Havenhand. Machine for cutting the teeth in sickles or reaping hooks, applicable also for cutting the teeth in reaping machine knives.

On March 29th.—1168 to 1178.—J. Darlington. Valves, method of working valves, and in feed motions for rock-boring engines, the improvement in valves, and method of working valves being partly applicable to other purposes.—M. J. Roberts. Foundations for bodies subjected to blows or pressure, especially applicable to anvils.—D. Bickford. Manufacture of pyroxyline to be employed as an explosive material, and in the manufacture of collodion, also in the treatment thereof when it is to be employed in the solid state for dental and other purposes (com. partly by Doctor Spooner, and the Pyroxyline Manufacturing Company).—C. N. Eyland. Buckles and fastenings of a similar nature.—A. V. Newton. Apparatus for ascertaining the rise and fall of temperatures, also for indicating the presence, and arresting the spread of fires (com. by Professor C. C. Grechi.—H. P. Thorp. Manufacture of artificial fuel.—J. Kennett. Improved dress.—B. Clarke. Wood-working machines, called trying-up and surfacing machines.—T. C. Newton and G. Dawson. Kitchen ranges.—G. Kemp. Artificial fuel.—H. Highton, M.A. Electric telegraphs, part of which are applicable to induction coils.

On March 31st.—1179 to 1193.—G. F. L. Meakin. Hanging sashes and shutters.—J. H. Johnson. Magnets (com. by H. Fontaine).—J. Goldsbrough. Apparatus for economising fuel in house fire-grates.—W. Taylor and H. L. Wilson. Wringing and mangling machines.—I. M. Singer. Improved cinder and ash receptacle for domestic and other fireplaces.—E. Holden. Treatment of wool and other fibres in the process of preparing.—T. Redmayne. Fire grates.—A. M. Job. Knife-cleaning boards, and parts to be employed in connection therewith. — H. Cochrane. Table knives and forks. (Complete specification).—W. Spence. Electric telegraphs (com. by F. F. Girarbon.—H. Marshall. Buckles or fasteners for straps.—A. Browne. Photography (com. by P. A. Despaquis).—G. H. Forbes. Balls, bricks, or blocks to be used as fuel.—H. J. Steel and R. W. Garland. Construction of domestic stove for economising the consumption of fuel and utilising the heat thereof.—A. M. Clark. Apparatus for the manufacture of gas for lighting and heating purposes (com. by A. Badt.)

THE FUTURE PRICE OF COAL.—It is from a general economy in consumption, and from scientific improvements in the manufacture of iron, that the greatest results are to be expected in diminishing the pressure upon the collieries, and consequently easing the market. But after all is done in these directions that can be reasonably expected the prices that have experienced such extraordinary inflation cannot, except for a temporary period during a general collapse or panic, suffer an equally extraordinary relapse. We have no hesitation in saying that to the average price of the ten years ending 1870 coal will never fall again.—*Iron.*

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TO GOVERNMENT ENGINEERS, RAILWAY DIRECTORS, LOCKING GEAR MAKERS, AND OTHERS.

The advertiser has invented, patented, and practically developed an improved accurate system of locking switch points and meeting points, accurate repeating and tell-tale signalling in all climates and in hot or cold weather; equally efficient in fog and in tunnels, for long range signals, and for the block system.

This system prevents the main line being worked when the cross line is blocked, and when necessary can be worked by the guard of the train. It also possesses many other practical advantages.

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THE INVENTORS' INSTITUTE,

ESTABLISHED 1st MAY, 1862.

FORTNIGHTLY MEETINGS, DURING SESSION,

HELD AT

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE.

Past President—Sir DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the Establishment of the Inventors' Institute, till his decease, February, 1868.

Past President—Lord RICHARD GROSVENOR, M.P., &c., from February, 1868, till May, 1871.

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